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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 2 (March – April 2022). This issue contains of nine interesting articles in multidisciplinary fields: (1) The effect of drying methods on the characteristics and functional properties of unripe banana (Musa spp.) flour: Air drying, freeze-drying and extrusion (2) Social support needs of the older persons during the second wave of COVID-19 pandemic in semi-rural Thailand (3) Social welfare system development for disparity aging in order to decrease social inequality in sub-district rural areas, Thailand: From the preliminary model to the extended area (4) Competency of non-formal education teachers (5) A causal relationship structure model of dietary behavior to control blood glucose levels of type 2 diabetes mellitus patients (6) Developing a traceability system for safe vegetables of smart farmers in Nakhon Pathom Province (7) Roles of the calendrical rites and traditions of Mon's life at Wangka Village, Sangkhlaburi District, Kanchanaburi Province (8) The effect of vocabulary development through narrow of second-grade learners and (9) Mapping the gender gaps in TVET practices: A literature review.

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
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The effect of drying methods on the characteristics and functional properties of unripe banana (Musa spp.) flour: Air drying, freeze-drying and extrusion

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Abstract

The study aimed to investigate the properties of unripe banana flour (UBF) subjected to several drying processes, including air drying, freeze-drying and extrusion, consider as a source of nutrients and a functional ingredient. The result showed that air and freeze-drying did not alter morphology, crystallinity and properties of UBF as much as did extrusion. The UBF obtained through air and freeze-drying had a higher resistant starch (69 – 72%) when comparing with the extrusion. Air and freeze-drying increased the water holding capacity and viscosity of starch paste, but decreased its solubility, swelling capacity and browning. Extrusion induced a strong degradation of the starch molecules resulting in reduced granule crystallinity (0.14 – 0.34%), resistant starch (< 0.3%), final viscosity (49 – 82 cP) and setback values (32 – 46 cP). In contrast, increased swelling power, solubility and browning were obtained with the use of extrusion. The gelatinization temperatures (76 – 88°C) and enthalpy of gelatinization (16 – 17 J/g) of UBF after drying with air or freeze-drying while extrusion method exhibited the flour with lower gelatinization temperature (54 – 74°C) and enthalpy of gelatinization (0.3 J/g). The results of this study may be useful in considering the UBF as a functional ingredient and a feasible drying procedure. The UBF obtained by air drying was economically viable than that obtained by freeze-drying verify. Nevertheless, both procedures could provide the UBF as an ideal material to be used as functional thickening agent for starchy processed foods and also as resistant starch to lower digestion. Extruded UBF could be employed in a variety of instant drinks and processed foods aimed for consumption by children and elderly.

Keywords: Banana flour, thermal properties, X-ray diffraction, pasting, functional properties

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1. Introduction

Drying is a technique which significantly removes an amount of water from food in order to extend its shelf life. It has evolved from traditional sun drying to more advanced methods such as air drying, spray drying, sprout bed, drum dried, vacuum drying and freeze-drying [1]. Each method may induce differences in properties, microstructure and other characteristics of the final dried products. Among these techniques, freeze-drying involves the direct sublimation of frozen ice at low temperatures and pressures. It is widely regarded as the best because it reduces cell damage while simultaneously enhancing food bodies, porosity structure, appearance and nutritional content of the finished product. However, its drawbacks are high production costs and energy consumption [1, 2]. On the other hand, the traditional hot air drying appeared to be the preferred drying manufacture due to lower production costs and energy consumption [2, 3]. Unfortunately, the quality of dried products is limited due to the surface destruction and cell rupture of the original foodstuff [4]. Extrusion is another technique that has been proven to be an efficient method for altering the qualities of grain, flour and starch. Extrusion involves high heating, pressure and shear forces which cause changes in all physicochemical and functional properties of the final products [5], for example, damaging the starch morphology [6 – 9], promoting starch gelatinization and changing thermal properties [3, 4, 10], disrupting the structure of the amylose and amylopectin chains and decreasing resistant starch [11, 12].

Bananas (Musa spp) are abundant in tropical and subtropical regions and widely consumed with a global production rate of 3.2% and 4.6 million hectares of agricultural land in 2020 [13]. Kluai Namwa (Musa spp. ABB) is the most popular and widely grown in Thailand and ASEAN with the world gross exported increased from 25.6 thousand tons in 2009 to 38.7 thousand tons in 2018 [14]. Even though most bananas were marketed fresh, unripe bananas can still be used and turned into flour which has been found to have several nutritional and nutraceutical benefits. Previous research discovered that banana flour contained a high amount of dietary fiber, mineral elements and it is a source of resistant starch [7, 15, 16]. Several authors recently investigated the use of unripe banana flour (UBF) in a variety of foods as well as the substitution of the other flours such as potato, corn and wheat in the food industry [16, 17]. The possible method for producing unripe bananas into flour has been suggested. Several drying technologies can be used to produce banana flour including air drying [4], freeze-drying [12, 18], ultrasonic and spray drying [19], sprouted bed [3, 20], extrusion [8, 11, 12]. However, when banana flour was obtained under various drying conditions, the quality of the products

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varies significantly. The assumption of this work was based on the concept that each different method for producing UBF has their own set of drawbacks. The appropriate technique, therefore, could not only be considered to increase economic viability but also to provide a worthy natural functional ingredient for the food industry.

The objective of this study was to determine the impacts of drying processes affecting the physicochemical, functional and structural properties of the physical modified UBF. The results could be proposed a suitable drying means for producing processed banana flour desirable for the food application.

2. Materials and Methods

2.1 Materials

The unripe banana (Musa spp. ABB) was cultivated locally in the Western region of Thailand and harvested 110 days after anthesis. Banana with the first stage of ripening process (whole green color) was selected to use as raw material in this study. The unripe banana (UB) was manually washed under running tap water, skinned and sliced (1 mm). The enzymatic browning reaction was inhibited by immersing the sliced UB in a 0.1% (w/v) alum sulphate solution for 10 min and then drained.

2.2 Drying methods

The UB samples obtained from section 2.1 were subjected to dry with four different drying methods. The first method was adapted from Babu *et al*. [21], the UB slices were air dried (AD) using a tray drier (JSOF-600W, South Korea). The UB slices were dried for 8 hours at 55 °C to achieve a moisture level of 8 – 10%. The second method was freeze-drying (FD), the UB slices were frozen for 24 hours at −18°C in a chest freezer (Sanyo, SF-C1497, Thailand). After that, the frozen UB slices were freeze-dried at −50°C in a vacuum freeze dryer (Scanvac cool safe55, Denmark) until they attained an 8 – 10% moisture content. In both cases, the dried UB slices were kept at room temperature, milled into powder and sieved through 60 meshes. The third and fourth processes flours were the AD and FD flours which were subjected to extrusion with a twin-screw extruder (CTE-D22L32, China). The moisture content of UBF was adjusted to 12% by adding water during the extrusion. Screw speeds were 450 rpm with a feed rate of 25 Hz. The barrel temperature profile in the three barrel zones from the feeder to the dry zone were set constant at 40, 70 and 90 °C which was adapted from Pico *et al*. [12]. The samples obtained from air drying with extrusion (AD-ED) and freeze-drying with extrusion (FD-ED) were cooled to room temperature, milled and sieved with a 60 mesh. All 4 differently modified UBF samples were packed in plastic bags, kept in an airtight container and stored at room temperature (30 °C) until further analyses. The moisture content of UBF was controlled at 7 – 9% in AD and FD, while 4 – 7% in AD-ED and FD-ED samples.

2.3 Proximate, total starch, resistant starch, amylose and amylopectin measurement

Protein, fat, dietary fiber and ash of UBF were analyzed by the AOAC standard methods [22]. Total starch and resistant starch of the samples were measured by glucoamylase methods [23] and determined using Megazyme kits (Megazyme international Ireland, Ireland). Amylose and amylopectin content were determined according to ISO 6647-2:2007.

2.4 Water holding capacity measurement

The UBF samples (100 mg dry basis) were soaked in deionized water (10 ml). The solution was agitated at 25 °C for 6 hours before centrifugation at 14,000xg for 15 minutes. Prior to evaporation of the sample at 105 °C, the supernatant was carefully removed and weighed (g). Water holding capacity was calculated using a gram of adsorbed water per gram of dried material [24].

2.5 Solubility and swelling power measurement

The samples (0.4 g dry basis) were mixed with deionized water (40 ml) in a centrifuged tube and then heated for 30 minutes at a temperature range of 40-90 °C with an interval of 10 °C. The suspensions were then centrifuged for 10 minutes at 3000xg. The supernatant was decanted and the sediments were weighed before being dried at 105 °C. The swelling power was calculated as weight of wet sediment/weight of dried sample. The solubility was calculated as (weight of dissolved solids after evaporation/ weight of original sample) x100 [21].

2.6 Color and browning index

The color analysis was carried out with a colorimeter chroma meter (Minolta CR310, Japan) using the CIE standard (L*, a*, b*). The CIE values of L* represent the range of dark to light color, a* represent the range of green to red color, b* represent the range of blue to yellow color. The browning index (BI) was calculated as BI = [100(X−0.31)]/0.172 whereas X = (a*+1.75L*)/ (5.645L*+a*−3.012b*) [25]. The hue angle was determined as $\tan^{-1}$(b*/a*), whereas the chroma intensity was computed as (a*2+b*2)1/2 [26].

2.7 Pasting properties

Pasting properties of sample were analyzed using a Rapid Visco Analyser (Newport Scientific RVA-4, Australia). The samples of 3 g (dry basis) added with 25 ml distilled water were subjected to a heating-cooling cycle. They were heated to 50 °C for 1 minute, then increased to 95 °C with a heating rate of 12 °C/minutes, and maintained at 95 °C for 2 minutes, cooled down to 50 °C within 2 minutes. The data from 4 different treatments were recorded to compared for peak viscosity, breakdown, final viscosity and setback.

2.8 Thermal properties

The thermal properties of UBF was determined using a differential scanning calorimeter (Perkin Elmer, DSC 8000, USA) modified from the method of Teng *et al*. [27]. Three mg UBF (dry basis) was weighed in a stainless pan (40 μl) and added with distilled water (9 μl), sealed and left at room temperature for 1 hr before measurement. The samples were subjected to a heat range of 20 °C to 120 °C with a speed rate of 10 °C/minutes. The onset temperature (T_0), peak temperature (T_p), conclusion temperature (T_c) and enthalpy of gelatinization (ΔH_{gel}) were recorded. The analyzed pan of each samples was stored for 21 days at 4 °C for retrogradation monitoring. The

Table 1. Proximate, total starch, amylose, amylopectin, resistant starch (%dry basis) and water holding capacity of UBF obtained from air drying (AD), freeze-drying (FD), air drying and extrusion (AD-ED) and freeze-drying and extrusion (FD-ED).

Parameters	AD	FD	AD-ED	FD-ED
Crude protein^{ns}	2.67±0.08	2.54±0.11	2.50±0.12	2.49±0.17
Crude fat^{ns}	0.69±0.40	0.73±0.18	0.74±0.24	0.72±0.16
Dietary fiber^{ns}	7.46±0.46	7.53±0.28	7.63±0.24	7.59±0.22
Ash^{ns}	2.84±0.17	2.83±0.32	2.92±0.20	2.77±0.24
Total starch^{ns}	82.54±1.30	83.44±0.03	84.60±1.90	85.06±1.82
Amylose	28.12^{c}±0.02	33.93^{b}±0.01	36.33^{a}±0.01	36.87^{a}±0.02
Amylopectin	71.88^{a}±0.02	66.07^{b}±0.01	63.67^{c}±0.01	63.13^{c}±0.01
Resistant starch	69.01^{b}±0.78	72.10^{a}±0.34	0.23^{c}±0.25	0.27^{c}±0.38
Water holding capacity (g/g)	12.48^{b}±0.17	15.70^{a}±0.14	1.04^{d}±0.02	1.35^{c}±0.08

^{a,b,c,d} The mean values in the same row with different letters are significantly different ($p \leq 0.05$).

^{ns}not significantly.

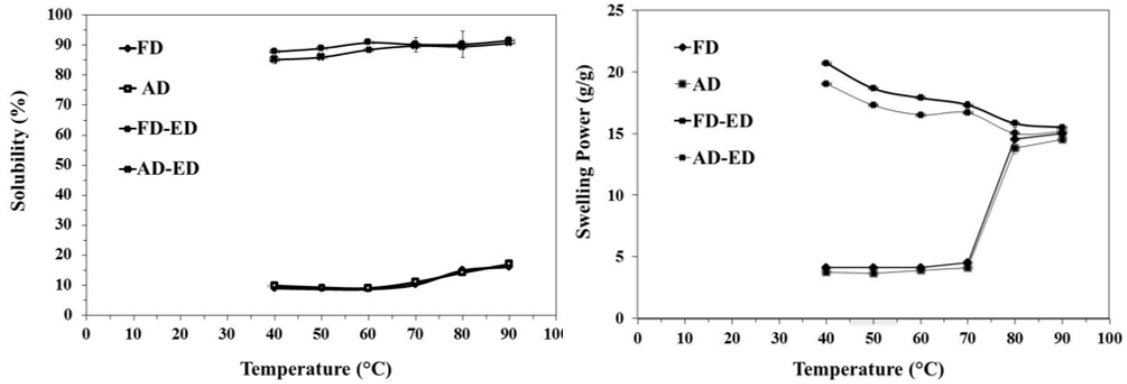

Figure 1: Solubility (left panel) and swelling power (right panel) of UBF obtained from air drying (AD), freeze-drying (FD), air drying and extrusion (AD-ED) and freeze-drying and extrusion (FD-ED) at different temperatures.

pan was rescanned using the similar temperature profile as previously mentioned. The enthalpy of rescanning was recorded as ΔH_{ret}.

2.9 X-ray diffractometry

The XRD diffractogram was constructed using a Bruker D8 Discover (Bruker AXS, Germany) with a voltage of 40 kV and 40mV with a step size of 0.02° at room temperature. The recording was made at a scanning speed of 1°/minutes and angle interval 2 to 45° (2theta). The ratio of the crystalline area with respect to the total area was used to compute crystallinity degree.

2.10 Microstructure

The UBF microstructure was obtained with a scanning electron microscopy (Tescan mira3, Czech Republic). The samples were sprinkled onto an adhesive tape attached to an aluminium stubs, covered with gold in a sputter coater prior to scanning. The microstructure was observed at the accelerated potential voltage of 15 kv and 350xmagnification were monitored.

2.11 Preparation of instant plant based soup

The plant base soup was prepared by mixing dried banana blossom powder 25%, as a major source of plant, coconut milk power 35%, pregelatinized starch 16% (control) and other ingredients 24%. The hot plant based soup was further processed by mixing these dried ingredients with hot water (80 °C) at a ratio of 1:6. The viscosity, browning index and resistant starch were determined using UBF from various drying methods with 100% substitution of pregelatinized starch.

2.12 Statistical analysis

All measurements were performed in triplicates. Data are presented as the mean ± standard deviation. The data analysis was performed with an ANOVA and the Duncan new multiple ranges test for mean differentiation at the 95% of significant confidence interval was carried out using the SPSS software version 23 (IBM, USA).

3. Results and Discussion

3.1 Proximate composition, total starch, resistant starch, amylose and amylopectin content

Drying methods had no effect on protein, fat, dietary fiber, ash and total starch content ($p>0.05$), but had a significant effect on amylose, amylopectin and resistant starches content ($p \leq 0.05$) as shown in Table 1. In this study, amylose content in UBF ranged from 28.12 to 36.87% similar to the finding of Bi *et al.* [7] and Nimsung *et al.* [28] who reported on the amylose

Table 2. CIE Color, browning index and water holding capacity of UBF obtained from air drying (AD), freeze-drying (FD), air drying and extrusion (AD-ED) and freeze-drying and extrusion (FD-ED).

Parameters		AD	FD	AD-ED	FD-ED
CIEColor	L*	79.24^{b}±0.06	81.78^{a}±0.27	56.58^{c}±0.36	57.70^{c}±0.81
	a*	2.54^{b}±0.08	2.00^{c}±0.03	7.48^{a}±0.12	7.38^{a}±0.20
	b*	11.63^{c}±0.01	10.26^{d}±0.18	16.72^{a}±0.51	15.95^{b}±0.47
Browning index		18.11^{b}±0.07	14.74^{c}±0.31	43.69^{a}±1.69	41.47^{a}±1.02
Hue		103.56^{b}±2.01	116.07^{a}±1.00	50.59^{c}±0.75	48.88^{c}±1.01
Chroma		11.90^{c}±0.83	10.46^{d}±0.19	18.31^{a}±0.52	17.57^{b}±0.87

^{a,b,c,d} The mean values in the same row with different letters are significantly different ($p \leq 0.05$).

Table 3. Pasting properties and thermal properties of UBF obtained from air drying (AD), freeze-drying (FD), air drying and extrusion (AD-ED) and freeze-drying and extrusion (FD-ED).

	AD	FD	AD-ED	FD-ED
Peak viscosity(cP)	3,984.16^{b}±184.37	6,921.33^{a}±110.45	545.00^{d}±45.31	871.28^{c}±71.43
Breakdown(cP)	643.28^{c}±66.43	1,535.00^{a}±180.03	469.33^{d}±49.66	1,243.79^{b}±56.20
Final viscosity(cP)	5,189.30^{b}±285.67	8,251.67^{a}±102.10	49.33^{d}±1.15	81.67^{c}±6.50
Setback(cP)	1,874.18^{b}±115.91	2,865.33^{a}±287.00	31.67^{d}±2.08	45.77^{c}±1.39

^{a,b,c,d} The mean values in the same row with different letters are significantly different ($p \leq 0.05$).

content in banana flour to be 26.10 – 32.05%. The amount of amylose of AD and FD samples (28.12 – 33.93%) were lower than the AD-ED and FD-ED samples (36.33 – 36.87%). The higher amylose content in flour after extrusion could be due to the fact that extrusion at a high temperature under shearing released more short chain starch, resulting in higher amylose content [11]. As a result, the components of amylopectin differ from those of amylose in a reciprocal manner. The UBF samples had high total starch content, with nearly 80% of starch, more than half of which was resistant starch with content values similar to those reported by Bezerra *et al*. [20]. UBF from AD had significantly lower resistant starch content (69.01%) than that of FD (72.10%). This could be due to the fact that the temperature (55 °C) during air drying was lower than the UBF gelatinization and transition temperatures (76 – 85°C). On the other hand, the freeze-drying technique may result in disorganized and chain rigidity in the starch structure [29], therefore, could promote the development of resistant starch to different extent from the air drying sample [4, 12]. The extrusion reduced the resistant starch by about 90% in AD-ED and FD-ED samples (0.23−0.27%). This phenomenon could be due to the high shear stress and temperature during extrusion, which destroyed the granules and the crystalline structures preventing the forming of more amorphous region [6]. This result was consistent with the finding of Sarawong *et al*. [11] who discovered that all extruded banana flour had a very low RS level with a drop of 91.5−98.1% compared to the native flour.

3.2 Water holding capacity

The water holding capacity (Table 1) of the AD sample (12.48 g/g) was significantly lower than that of the FD sample (15.70 g/g) ($p \leq 0.05$). This might be due to the difference in the surface of the starch particles. In case of FD, the UBF was dried under sublimation of ice crystal, resulting in a porous structure. The water then could be able to interact well with the starch chains, this increasing the water holding capacity [18]. The result agreed with those of Ahmed *et al*. [4] who reported green banana flour processed by tray drying and air oven drying had lower water holding ability than green banana flour processed by freeze-drying. The AD-ED and FD-ED samples had the lowest in water holding capacity (1.04 – 1.35 g/g) comparing with AD and FD samples. This result conformed to that of Sarawong *et al*. [11] who found that the extrusion of banana flour processed under high temperature (80 – 130°C) and low moisture content (20%) decreased water holding capacity of the flour from 2.44 g/g to 1.47 – 1.95 g/g.

3.3 Solubility and swelling power

The solubility is an indicator for the amount of soluble molecules leach out from the starch granule [17]. As illustrated in Figure 1, The AD and FD samples (8 – 19%) had lower solubility compared with those of AD-ED and FE-ED samples (84 – 90%). This could be the results of the dextrinization process during extrusion which caused degradation and fragmentation of the starch granules, leading to the formation of significantly more water-soluble products [8]. It was in accordance with the report of Sarawong *et al*. [11], in which the solubility of extruded banana flour was increased 77.45% from 7.60% in native flour.

The swelling power of starch is a measurement of the starch granules ability to bind water during temperature range of 40 °C to 90 °C (Figure 1). The AD and FD samples had swelling power substantially lower than those of the AD-ED and FD-ED samples. This was owing to the pregelatinization occurred under extrusion process. When the temperature was elevated to 80 – 90°C, the swelling power of the AD and FD samples grew dramatically. This peculiar behavior might cause by the varied gelatinization temperatures of the UBF, which were found to be between 76 – 88.40°C for a group of AD and FD and 53.9 – 73.80°C for a group of extrusion (AD-ED and FD-

Table 4. Thermal properties of UBF obtained from air drying (AD), freeze-drying (FD), air drying and extrusion (AD-ED) and freeze-drying and extrusion (FD-ED).

	AD	FD	AD-ED	FD-ED
Gelatinization				
T_0 (°C)	76.10^{b}±0.02	78.99^{a}±0.03	53.9^{d}±0.25	54.10^{c}±0.16
T_p (°C)	79.00^{b}±0.14	83.30^{a}±0.05	62.16^{d}±0.35	65.09^{c}±0.26
T_c (°C)	85.02^{b}±0.25	88.40^{a}±0.31	72.87^{d}±0.16	73.80^{c}±0.17
ΔH_{gel}(J/g)	16.06^{b}±0.09	17.39^{a}±0.09	0.29^{d}±0.01	0.31^{c}±0.01
Retrogradation				
T_0 (°C)	74.98^{b}±0.23	79.00^{a}±0.06	33.64^{d}±0.54	34.66^{c}±0.19
T_p (°C)	79.00^{a}±0.06	83.28^{a}±0.07	59.53^{c}±0.77	59.79^{c}±0.13
T_c (°C)	93.25^{b}±0.33	94.28^{a}±0.44	73.53^{d}±0.14	74.50^{c}±0.09
ΔH_{ret}(J/g)	13.93^{b}±0.11	14.77^{a}±0.15	8.24^{d}±0.14	8.54^{c}±0.17

^{a,b,c,d} The mean values in the same row with different letters are significantly different ($p \leq 0.05$).

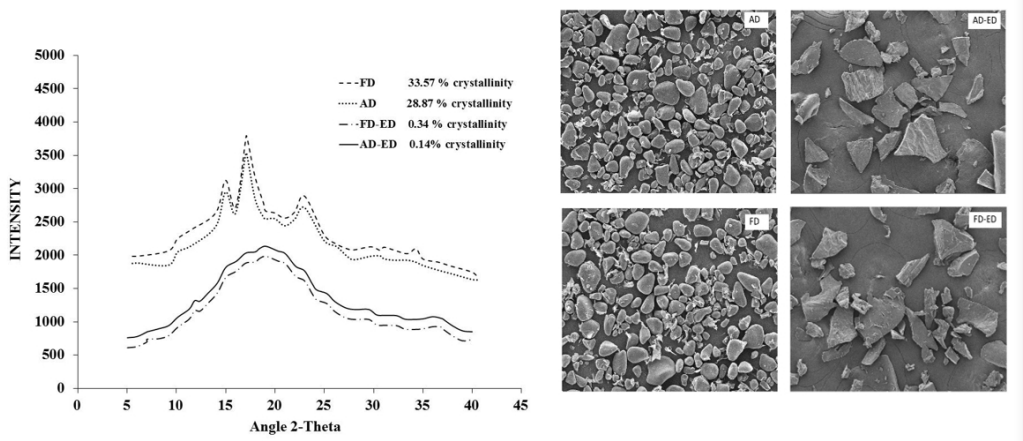

Figure 2: X-ray diffractograms and microstructure (350x) of UBF obtained from air drying (AD), freeze-drying (FD), air drying and extrusion (AD-ED) and freeze-drying and extrusion (FD-ED).

ED). The result was consistent with that of Agama-Acevedo *et al*. [16] who reported the banana flour from four varities (Macho, Enano, Valery and Morado varities) was soluble and more swelling when heated to gelatinized temperature (approximately 70 − 80°C). The studied of Zheng *et al*. [30] had a similar pattern of the swelling of the native banana flour and extruded samples.

3.4 Color and browning index

The AD sample had lower lightness (L*), but higher redness (a*) and yellowness (b*) values than those measured in FD sample as shown in Table 2. The difference in color could be seen clearly using hue, chroma and browning indicating that AD samples had lower hue (104), higher in chroma (11.90) and in browning index (18.11) than FD samples where relevant values were 116.07, 10.46 and 14.74, respectively. This browning phenomenon was hypothesized to be the result of Maillard reaction which occurred more strongly during the heat transfer of the air drying process than during freeze-drying [4, 18, 31]. The AD-ED and FD-ED had the highest redness (a*) and yellowness (b*) values, while the lightness (L*) values were the lowest. The hue, chroma, and browning index results showed a corresponding change, which resulted in more melanoidin formation and a darker browning color during the extrusion process [6].

3.5 Pasting properties

The pasting properties of UBF as function of various drying conditions are presented in Table 3. The results revealed that the peak viscosity, breakdown, final viscosity and setback values of the AD sample were significantly lower than those of the FD sample. This was due to the lower amylose content of AD sample that may be less capable of binding water and re-associated in starch chain. As a result, UBF dried by air drying had greater stability but less retrogradation than UBF dried by freeze-drying [3, 32]. The AD-ED and FD-ED samples had significantly lower in pasting properties than AD and FD samples (Table 3). It could be attributed to the greater degree of gelatinization, shear fragmentation and the degradation occurring during extrusion. Sarawong *et al*. [11] reported a similar reduction trend of the pasting properties in extruded green banana flour, with peak viscosity reducing from 1,293 to 114 cP, breakdown value reducing from 543 to 101 cP, final viscosity reducing from 1,064 to 39 cP and setback value resulting from 314 to 26 cP. This observed phenomenon clearly indicated that the extrusion improved the properties of banana flour in terms of reducing both viscosity and retrogradation, increasing the solubility and the swelling power at already low temperature which may be suitable for instant drinks and processed foods aimed for consumption by children or elderly.

Table 5. The viscosity, resistant starch, fiber, protein and browning index of plant based soup mixed with UBF obtained from air drying (AD), freeze-drying (FD), air drying and extrusion (AD-ED) and freeze-drying and extrusion (FD-ED).

Parameters	Control	AD	FD	AD-ED	FD-ED
Viscosity (cps)	5182^{b}±212	5382^{b}±112	$5{,}512^{a}$±198	$2{,}865^{c}$±371	$2{,}745^{c}$±267
Resistant starch(% dry basis)	0.01^{b}±0.13	9.13^{a}±0.33	9.21^{a}±0.68	0.02^{b}±0.02	0.03^{b}±0.17
Browning index	36.41^{b}±0.13	36.71^{b}±0.13	35.88^{c}±0.27	39.32^{a}±0.21	38.91^{a}±0.87

^{a,b,c} The mean values in the same row with different letters are significantly different ($p \leq 0.05$).

3.6 Thermal properties

The thermal properties were employed to quantify the gelatinization and retrogradation phenomena as shown in Table 4. The gelatinization temperatures (T_0, T_p and T_c) in the AD sample ranged from 76 to 85 °C were lower than those in FD sample (79 – 88°C). ΔH_{gel} of the AD sample was also significantly lower (16.06 J/g). It indicated that AD sample required less energy to gelatinize and melt the ordered structure. FD sample was dried under sublimation mechanism might cause internal rigidity structure that resisted the gelatinization, so inducing higher resistant starch and amylose contents [4]. The results agreed with those of Ahmed *et al.* [4] who reported the gelatinized temperature and ΔH_{gel} of green banana flour obtained from air drying to be lower than that obtained from freeze-drying. The AD-ED and FD-ED samples had lower transition temperatures and ΔH_{gel} than AD and FD samples. The extrusion caused degradation and fragmentation of the starch granules, thus lower temperature was required to melt the ordered structure within starch granules.

In order to monitor the retrogradation behavior of UBF, the gelatinized samples were stored at 4 °C for 21 days. The results showed a similar trend to those of the gelatinization process, revealing much higher ΔH_{ret} (13.93 – 14.77 J/g) found in AD and FD flour in comparison with the AD-ED and FD-ED samples (ΔH_{ret} 8.24 – 8.54 J/g). This behavior indicated a certain effect of the extrusion on amylose and amylopectin which might lose their ability to retrograde and could result in the low setback value of the extruded UBF as mentioned previously [8].

3.7 X-ray diffractometry

X-ray diffractometry (XRD) is a method to analyse the amorphous and crystalline zone of the polymer. It is used to determine the structure of carbohydrate in flour or starch. The crystallization characteristics of the starch granules of the UBF obtained for the different drying means were in Figure 2. One can clearly notice that the XRD pattern of the AD and FD samples exhibited similarity pattern with a region of three prominent peaks. The highest peak located at 2θ of 17° and two minor peaks located at 2θ of 14° and 22° respectively, with a high degree of starch crystallinity of 28.87 – 33.57%. This diffraction pattern is consistent with a β type conforming to the findings of previous studies [4, 7, 33 – 35]. The extrusion affected the XRD pattern of the starch of AD-FD and FD-ED by eliminating the organized starch crystalline structure (crystallinity 0.14 – 0.34%), the diffractogram formed a high pattern of an amorphous state nearly 99%. This is possibly caused by the mechanisms of the extrusion process which damaged the starch granules and the crystallinity. These results were in agreement with those of Giraldo-Gomes *et al.* [8] and Pico *et al.* [12] who also reported the altered XRD starch pattern of the extruded banana flour compared with those of the native drying.

3.8 Microstructure

SEM images of the UBF showed further that the surface morphology was also affected by drying process (Figure 2). The particles obtain from AD and FD had similar and mostly irregular shapes and sizes, tending to exhibit oval shape and spheroid forms, wherefore some small particles were round. [4, 7, 17, 20, 21, 28]. Bi *et al.* [7] argued that banana flour particles were most often long and oval in shape with small and larger surface areas, which tended to be more susceptible to enzymatic digestion with a higher digestion rate. On the other hand, the SEM picture of the AD-ED and FD-ED samples showed evidence of more irregular shape of the flour particles. This morphology was due to the gelatinization of the UBF and degradation phenomenon when subjected to high shear and temperature [6, 8, 9].

3.9 Instant plant base soup properties

Instant plant base soup was prepared by using pregelatinized starch as a thickener (control sample) and the properties of the samples prepared by using 100% substitution of pregelatinized with UBF from several drying methods were shown in Table 5.

The viscosity and browning index of the soup with the UBF derived from AD and FD samples did not differ, in same case, from the control sample ($p>0.05$). As expected, the soups added with AD and FD samples had higher levels of resistant starch than the control. The soups prepared with AD-ED and FE-ED samples were not significantly different from the control ($p>0.05$), having a lower viscosity and a darker color. The findings suggested that the modified UBF acquired through air and freeze-drying should preferably be used as a functional thickening agent in soup, whereas those samples obtained through extrusion could be used as instant drinks which need less viscosity property.

4. Conclusions

Overall, the physically modified UBF properties were influenced by drying technique. The UBF dried by air drying had significantly darker and negative characteristics as considered by the content of resistant starch, amylose, pasting and thermal properties as compared to the freeze-drying process. In terms of flour qualities and economic feasibility, air drying was found to be the suitable method to generate the modified UBF because it used less energy during processing than the freeze-drying. Nevertheless, both techniques produced the modified UBF samples with high resistant starch content indicating that they could

be employed as a functional thickening ingredient in the food industry and these two drying means may be appropriate for altering the UBF properties to expect for the slow digestibility and result in low glycemic index of the product such as soups. The combined extrusion with air and freeze-drying exhibited destructured starch granules and resulted in a darker color and lower content of resistant starch. The strong degradation of the starch structure and morphology of the extruded UBF caused lower paste viscosity and a lower energy requirement for gelatinization, resulting in higher solubility and swelling power at a lower temperature. Consequently, the extruded UBF became more soluble in water allowing it to be used for instant drinks and food products aimed for consumption by the elderly and children.

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Social support needs of the older persons during the second wave of COVID-19 pandemic in semi-rural Thailand

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Abstract

Objectives: COVID-19 is an emerging infectious disease; infected older persons are more likely to depart than other ages. Also, people with a lack of social support can get the infection easily. This study aimed to examine the social support needs of older persons and compare the differences in the social support needs by factors of age, sex, occupation, underlying medical conditions, marital status, and family economic status.

Study design: Descriptive study design.

Methods: Data were collected from 267 older persons who lived in semi-rural Thailand during the second wave of the COVID-19 pandemic by a self-administered questionnaire or face-to-face interviews. The data were analyzed using descriptive statistics, an independent sample t-test, and one-way ANOVA.

Results: All participants required social support, while 56.2% needed a high level. The top three aspects needed include distributing the old-age allowance in the community (86.9%), supporting disease prevention equipment (83.1%), and providing a place to coordinate and a person who could provide information about COVID-19 thoroughly in the community (80.1%). Older persons with underlying medical conditions needed significantly higher social support than those without diseases ($p < .001$. Statistically insignificantly differences in social support needs ($p = .86$) are found by sex ($p = .83$), occupation ($p = .52$), marital status ($p = .56$), and family economic status ($p = .94$).

Conclusions: The overall social support needs of the participants were at a high level. Increasing old-age allowance and supporting protective materials, coordinating sources, and providing information about COVID-19 thoroughly in the community, and the tailed care delivery for those underlying medical conditions are recommended.

Keywords: COVID-19, older person, semi-rural, social support

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1. Introduction

COVID-19 is an emerging infectious disease caused by the coronavirus. It all started in Wuhan, China, where the outbreak spread rapidly across the world. Populations of all ages are equally inclined to infection but infected older persons are more likely to depart than other ages due to their unhealthy physical condition and reduced immunity, especially the older persons with underlying diseases such as diabetes, high blood pressure, chronic lung problems, and kidney disease, cardiovascular disease, cancer, and much more [1]. In 2020, Lim *et al.* [2] reported the situations of COVID-19 among older people in Asia and found that the mortality was higher in the older age groups, ≥ 80 and $65 – 79$ age groups compared with the $50 – 64$ age group (18.8% vs. 4.5% vs. 1.2%, $p = .025$). Similarly, the mortality rate due to COVID-19 from the first wave of outbreaks among older persons in Thailand was higher than in other ages, accounting for 11.06 percent of the total number of infections in all ages, and the death rate among patients over 60 was 6.4% [3]. This figure calls for actions from public authorities worldwide to support older persons to meet their needs and manage their health issues more effectively.

To comply with the COVID-19 strategic management policies, older persons, therefore, have to abide by several intensive measures for monitoring themselves and others, such as social distancing, mask-wearing, self-quarantine, and self-isolation. These measures also cause a direct negative impact on older persons physically, morbidly, economically, and socially [4]. Moreover, the natural spread and transmission of the disease had made it difficult for older persons to take care of themselves differently from the usual ways. For example, they may have to be separated from their family members, or they have to talk, communicate or touch each other less. These social isolations have raised the issue of whether older persons receive adequate social support in response to their needs.

Based on previous literature, social support is referred to as support that is provided by other people and arises within the context of interpersonal relationships [5]. Different kinds of social support include instrumental/material, informational, emotional support, and so forth [5-7]. These are potential resources for people during crisis or stress. Previous epidemiological studies found that people with a lack of social support can easily get the infection due to endocrine changes and reduced immu-

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nity [6-8]. Also, a recent study in China [9] revealed that social support moderated the relationship between perceived uncontrollability and mental health symptoms during the COVID-19 epidemic among the general Chinese population. The literature review has limited reports exploring the need for social support among older persons during the COVID-19 pandemic in rural Thailand. Hence, this study will provide information on the actual social support needs of older persons according to their lifestyles and contexts in a semi-rural community in Thailand. The findings may be useful for the public authorities to design further social support and support systems appropriate for this population group.

2. Method

The research design was a descriptive study. The population was 156,470 people [10], aged over 60 years old, who were selected by multistage sampling method. The research setting was Nakhon Pathom province, a semi-rural area in the central of Thailand sixty-five (65) kilometers away from Bangkok Metropolitan. During the second wave of the COVID-19 epidemic in Thailand, the impact of the situation among the older population in this area differs from rural and urban in terms of social support needs [11]. For the sample selection procedure, first, randomized 3 districts out of 7 by simple random sampling; second, randomized 1-2 sub-districts from 3 main districts by simple random samplings; and third, drew a simple random sample of the 66-67 older persons from each sub-district.

The sample size was calculated using a power analysis computer program. The correlation of selected factors with individual needs for social support was tested using one-way ANOVA statistics. The test power was set at 0.90, while the effect size was set at 0.25 (medium effect size). There were six primary variables with a statistical significance of 0.05. The sample in this study was 267 participants [12].

2.1 Inclusion criteria

The community-dwelling older persons who participated in the research had the following qualifications:

1. Aged 60 years old or over;
2. Residing in Nakhon Pathom Province during the COVID-19 pandemic for at least 6 months;
3. Good consciousness and ability to communicate in the Thai language;
4. No serious illness/es or bedridden or handicapped; and
5. Consenting to participate in the study

2.2 Research instrument

The questionnaire on social support needs contained ten (10) items to assess both perceived objective and self-report subjective with yes or no scales that comprised one (1) item for overall social support needs and nine (9) items of three (3) aspects. These included six (6) items in the material aspect, two (2) items in mental aspect, and one (1) item in the information aspect. The score of social support needs ranged from 0 to 10. After calculating the score of all items, the researcher compared the scores with the standard criteria as follows: $0-5$ points ($\leq 59\%$) means low support need, $6-7$ points ($60-79\%$) means moderate support need, and $8-10$ points ($\geq 80\%$) means high support need.

The construct validity of all questions has been verified by three (3 experts), two (2) nursing instructors, and one (1) associate professor who specializes in measurement and evaluation. The index of Item-Objective Congruence (IOC) was 0.85. The reliability test of the assessment with thirty (30) samples yielded Cronbach's alpha coefficient of 0.89. However, the actual Cronbach's alpha coefficient was 0.94.

Data were collected by a self-administered questionnaire or face-to-face interviews. The seven (7) researchers and all participants have to abide by the strict epidemic prevention measures. For participants with impaired vision and/or unable to read, the questions were read out by the researchers, then answers were recorded respectively. Data collection was conducted from late March to April 2021. The data were analyzed by descriptive statistics. T-test was used to compare the gender, occupation, medical conditions, and family economic factors with social support needs, and one-way ANOVA was applied to compare age and underlying medical conditions with social support needs.

3. Results

3.1 Response rate

The questionnaires were distributed to 267 participants and 100% were returned. The personal data were kept confidential to protect the human rights of older persons.

3.2 Personal attribute

The participants aged between $60-81$ years old and the average age was 71.4 years (SD = 8.4). About half were early seniors ($60-69$ years old) (47.9%), and about one in six were late seniors (80 years old and above) (16.9%). About eight in ten of participated in the study were female (76.8%), while two in ten were male (23.2%), of which half of them were married (56.2%). More than half were still self-employed (66.7%). Most of them were categorized at low family economic status (84.2%). In addition, most of the participants had underlying medical conditions (75.7%).

3.3 Social support needs

All participants (100%) needed social support. 56.2% of them had a high need for social support, 26.2% had a low need for social support. After considering each aspect, it was found that 80.2% had a need for these three (3) aspects-materials, psychological and informational supports. The top three social support needs were distributing the old-age allowance directly instead of receiving the money by oneself at the local administrative office or transferring it to bank account (86.9%), followed by encouraging government agencies to help procure disease prevention equipment such as cloth masks, surgical masks, alcohol solution or alcohol gel (83.1%), and providing a coordination unit as well as an information center about COVID-19 thoroughly in the community (80.1%), and having ways

Table 1. Social support needs of older persons (n = 267).

Social Support Needs	Frequency	Percentage
Material aspects		
1. The older adults wanted the government agencies to provide dried food, canned food, or fresh food for their consumption.	58	21.7
2. The older adults wanted the government agencies to provide cooked food for their consumption.	111	41.6
3. The older adults wanted the government agencies to provide them a safe shelter free from COVID-19 outbreak.	33	12.4
4. The older adults wanted the government agencies to distribute old-age allowance directly to them instead of bank transfer or receiving the money at the Subdistrict Administrative Organization (SAO).	232	86.9
5. The older adults wanted the government agencies to procure disease prevention equipment such as cloth masks, surgical masks, alcohol spray, or alcohol gel.	222	83.1
6. The older adults wanted the government agencies to provide home health services such as primary health checkups, dissemination of health education practices such as wound care, physical rehabilitation, and directly distribute prescribed medications individually.	44	16.5
Psychological aspects		
1.The older adults wanted to have channels in expressing their inner feelings such as fear, stress, loneliness, or depression.	139	52.1
2. The older adults wanted to have friends or elderly club members to talk or stay with them at some point in time.	80	30.0
Informational support		
1. The older adults wanted to have a reliable source of information about COVID-19 in their community.	214	80.1

for expressing inner feelings such as fear, stress, loneliness, depression (52.1%), as shown in Table 1.

4. Personal Attributes and Social Support Needs

The results showed that the participants with medical conditions had a greater need for social support than those without any medical conditions statistically ($p < .001$). Although the sample group had different factors including age, gender, occupation, marital status, and family economic status, all had the same level of needs for social support as shown in Table 2 and Table 3.

5. Discussion

The participants were older persons, in the early, middle, and advanced ages. There were more females than males which were consistent with the population structure in Nakhon Pathom Province with a population aged 60 years and over representing 17.0%, 9.8% of females, and 7.2% of male [10]. Even though most of the participants had underlying chronic diseases, they were still healthy and able to carry out things on their own. It was found that 66.7% were able to run their own business and continue their jobs, who had some insufficient family economic status which is consistent with the situation in other areas across the country where people are facing problems with insufficient funds. This finding was similar to the study in Singapore, in which 27.0% of older women and 22.0% of older men reported having no savings at all [13]. The result was also consistent with the report of the Asian Development Bank in 2020 stating that around 40.0% of older men and 22.0% of older women proposed their source of income from their work [14]. The insufficient income of older persons makes them a more vulnerable population group, which was observed in the previous study which found that the precariousness of older adults' financial statuses was associated with the experience of psychological distress [15].

The results showed that all participants (100%) needed social support, of which material support was greatly required than any other aspects. The research revealed that the need for material support was a fundamental factor in the prevention of COVID-19, whether cloth masks, surgical masks, alcohol solution or gel. It was possible that the participants and their families had limited access to buying those kinds of stuff during the epidemic in Thailand, which made them need support in this aspect the most. During the first wave of pandemics, Thailand faced a shortage of these equipment and price issues. Moreover, with a new or the second wave of pandemics, the participants were in high demand for these kinds of stuff.

As for distributing the old-age allowance directly instead of receiving the money by oneself at the local administrative offices or transferring to bank account, it was explained that the participants had the main income from the old-age allowance, which was inconsistent with the expenses. In this study, most older persons received income from the old age allowance-600 Baht for those of 60 – 69 years old, 700 Baht for those of 70 – 79 years old, 800 Baht for those of 80 – 89 years old, and 1,000 Baht for those over the age of 90. This finding was consistent with the report that old age allowance is the source of income 23.0% of women and 17.0% of men in Thailand [14]. The total value of the allowance which is fewer than 2-day minimum wage of 345 Baht per day was inadequate that prompted most of the participants to still run their own business, agriculture, fishing, etc.

Even though the sample group is still engaged in a certain occupation, with the current outbreak and the need to comply with measures to prevent infection and the spread of COVID-19, they were reluctant to come to the local administrative office and receive their old-age allowance, even going to the cash machine or withdrawing money from the bank. Furthermore,

Table 2. Comparison of social support needs with ANOVA statistics (n = 267).

Variable / Variance Source	Sum of Square	df	Mean Square	F-test	p-value
Age					
among groups	1.5	2	.8	.2	.86
within groups	1349.8	264	5.1		
total	1351.3	266			
Marital status					
among groups	5.9	2	3.0	.6	.56
within groups	1345.3	264	5.1		
total	1351.3	266			

Table 3. Comparison of social support needs by t-test (n = 267).

Variable	Mean	S.D.	t-test	df	p-value
Gender					
female	6.8	1.6	.2	1	.83
male	6.8	1.5			
Occupation					
self-employed	6.7	2.3	.7	1	.52
unemployed / retired	6.9	2.0			
Medical Conditions					
no	3.6	1.7	22.1	1	< .001
yes	7.8	1.2			
Family Economic Status					
sufficient	6.8	2.2	.7	1	.94
insufficient	6.8	2.3			

during the second wave of the pandemic, public transport in semi-rural communities was limited especially on the COVID-19 prevention policy, even those with private vehicles. Therefore, the respondents preferred the Thai government to let the community leaders distribute the subsistence allowance directly to them.

Apart from that, the results also showed that most of the participants were reluctant to be provided health services at home, e.g., primary health checks, wound care, physical therapy, and medications dispensing for their underlying diseases. The reasons was participants did not want to allow outsiders to visit their homes due to the fear of the spread of COVID-19 [2]. In addition, the sample group did not need the government agencies to help them with dry food, canned goods, and ready meals since they were not compatible with their way of life. The main livelihood of the participants was the consumption of fresh food, vegetables, and fruits that were home-grown and could be obtained from around the community. These individuals preferred to follow their personal eating patterns and did not want to mingle with other people if it was not essential. In addition, the samples also lived in an agricultural area in which fruits and vegetables were in abundance [10]. Therefore, finding food within the households or communities was not a problem.

Besides, the results showed that the participants needed a center for coordinating and providing information about COVID-19 in the community, since Nakhon Pathom Province was the province where the first older patients with COVID-19 were found [16]. Although the government has conducted a press conference and provided information about COVID-19 to the public through online media, local radio, and television every week, there might still be limitations on the older persons' access to information. According to the semi-rural culture, the older persons were more likely to trust information from community health teams or community leaders than from news on the radio, television, or from other people. Inadequate information related to COVID-19 infection could affect the seniors psychologically and create fears. A previous study revealed that feelings of frustration and uncertainty tend to occur even on the concerns of inadequate information and basic supplies [17-18], and the need to better understand the elements of national responses through a resilience lens as proposed in the recent research [19].

Older people with medical conditions infected with coronavirus would most likely have more severe symptoms compared to other ages [1, 6, 9, 15, 17]. The results revealed that the participants with certain medical conditions had a greater need for social support than those without any conditions, which were congruent with several previous studies. The need for social support on materials such as preventive equipment, psychological assistance, and information support depended on those who need it the most. These were consistent with the overall picture of Thailand which was found that older persons with medical conditions are at high risk of getting severe symptoms once infected [3]. To mitigate the situation, the government was implementing drug distribution reinforcement by the village health volunteers or postal services directly to the patient's home.

Lastly, although the participants were of different ages, gender, occupation, marital status, and family economic status, they had similar social support needs. This could be explained by the fact that COVID-19 is an emerging infectious disease that affects everyone without exceptions, as mentioned in previous studies [1, 4, 13]. The findings in this study were opposed to various ASEAN countries [2] which proposed that people with low-socioeconomic status were less likely to receive preventive materials from the government and those staying alone often relied on ad-hoc support from non-government organizations (NGOs) and volunteers than the general population [1]. According to Thai culture, especially in a rural community, daughters or sons are usually responsible for taking care of older family members. Moreover, the extended family with relatives living in the same village might help to support each other, and the older people are generally well-respected according to Thai culture. This was in line with previous studies that found 48.8% of the family members, a daughter or son, were the closest helpers for their family when getting acute disease [20]. In addition, the health volunteers, more than one (1) million volunteers [14] are working in the community nationwide to take care of the housebound older people. However, this finding might have different results in another context. The strength of the study was the high response rate covering wide ranges of older ages and face-to-face data collection which was rich in data related to a semi-rural community. The weakness of the study was the question about the information aspect which was just only one question.

6. Conclusion

The overall social support needs of older persons in semi-rural Thailand were at a high level. The findings of this study indicated that materials on the aspects of preventive equipment and old-age allowance were also at a high level of need. It was also showed that a channel for older persons to express their inner feelings like fears, stress, loneliness, and depression was required. Moreover, most of older persons need a center for coordinating and provide information about COVID-19 in the community. Older persons with medical conditions need more social support than those without any.

7. Recommendation

7.1 Suggestions from study findings

Public authorities should consider more on old-age allowance and facilitate the distribution in the community. Government agencies should provide targeted and tailored messages according to the most reliable scientific evidence within the area organized by community leaders or village health volunteers.

Moreover, the tailored older caring program should focus on developing their potential for self-care and encouraging family members or people in the same community to become a supporter. Mental health or public health agencies should consider strategies for older persons who needed to express bad feelings, such as establishing virtual counseling center or organizing online group psychological activities.

7.2 Suggestions for the further study

The experimental studies should be conducted, and also mixed-method design to understand more on older persons' needs, design a new normal life policy for active aging, and develop a program to strengthen family leadership development of older persons with mental health problems.

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Ethical approval

This study is part of a research project on the quality of life of older persons during the second wave of the COVID-19 pandemic in Nakhon Pathom Province, accredited for human research ethics of the Human Research Ethics Committee, Nakhon Pathom Rajabhat University with a certification number of COA No. 070/2021 on March 18, 2021.

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Competing interests

None declared

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Social welfare system development for disparity aging in order to decrease social inequality in sub-district rural areas, Thailand: From the preliminary model to the extended area

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Abstract

The preliminary model of social welfare system for social inequality reduction of the elderly has been applied in sub-district areas with the process of finding key factors leading to integrate activities related to sub-district plans. The new model is more prominent with respect to the dimensions of welfare and human dignity. The innovation results have mostly emerged from the spirit volunteers. Social inequality among disadvantaged seniors had decreased significantly. The research suggested that policy proposals based on empirical data should be used to specify the activity operations and a continuous learning exchange with the sub-district network involvement should be done.

Keywords: Aging, disparity, inequality, social welfare

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1. Introduction

Thailand's endeavor to support its aging society has resulted in disparity in the sub-district rural areas. The evidence from this development reflects that many elderly people do not have enough income to survive. Moreover, their household spending and health expenditures are likely to increase. This situation causes inequality with respect to access to social services or welfare and leads to unnecessary, unreasonable, or unintended consequences. The dimensions of inequality that should be given high importance in the elderly population are the economic dimension, the welfare dimension, and the human dignity dimension [1]. According to the National Plan of the Elderly, participatory activities and proactive strategies are continually created for promoting the well-being of the elderly [2]. The community volunteers and the center of quality-of-life development for the elderly in the community are set up. However, there are a number of the elderly who are often in the underprivileged groups and still need rights and welfare access in order to remain valuable members of society.

The underprivileged seniors need basic housing facilities, as well as health and social services which are not different from the general elderly. However, disadvantaged people are not able to manage the obstacles due to their inherent limitations or the effects of social separation. Therefore, they do not receive appropriate social welfare which results in disparity due to lack of opportunities and inequality [3]. Although Thailand has various types of social welfare for the elderly, there are still many problems and obstacles to the operation at the sub-district level, for instance, the mechanism for driving the welfare of the elderly lacks integration and continuity from policy to practice, resulting in not achieving the target and not responding to the real problems of the underprivileged elderly [4].

Older people living in sub-district rural areas are easily classified as underprivileged elderly because their lifestyles are in a less developed context. As a result, they are limited in managing their lives, lack access to health care services, and have unstable livelihoods. In addition, they sometimes are neglected by their families [5]. Although there are no reports of the number and characteristics of disadvantaged elderly at the sub-district level, the disparity can be implied from the a high proportion of elderly people in sub-district rural areas who are living alone or with a spouse, have a low income, are restricted in their daily activities, or suffer from a chronic disease [2]. The research results reflected that there are types of welfare that the disparity group has never accessed. The social welfare rights that the elderly have never accessed but need include care from family members during difficult times. In addition, the allowance is not enough to sustain their needs in later life, and lack of continuous monitoring and evaluation of related government policies [3]. Therefore, the elderly are unable to access essential or basic services including economic, welfare, and human dignity and it leads them to be the underprivileged group in the cycle of hardship at the end of life.

One of the best Sub-district or Tambol models of care that encourages the elderly to access social welfare is called "Ban Klang" using the kindness to help the underprivileged elderly without a caregiver. An elderly club or elderly school is the main mechanism to promote elderly welfare. The local sec-

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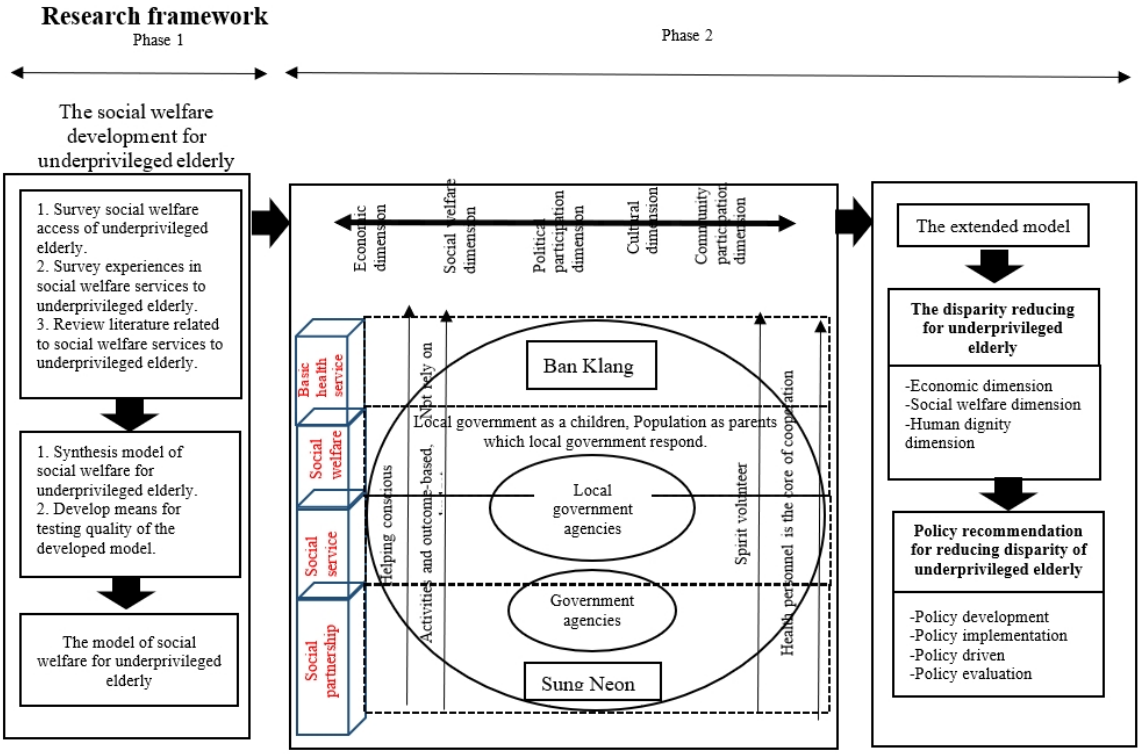

Figure 1: Research framework.

tors coordinate together and encourage the community members obligate to the elderly [6, 7]. However, the provision of social services to the elderly at the sub-district level might differ according to the context, which the original model has the prominent characteristics of not using community buildings to provide social services to the elderly, while other districts often use those to carry out elderly activities. The extension of the model from the sub-district to the other sub-districts is one of the options to prove the efficiency and effectiveness of this model. In addition, it helps to know what factors or circumstances should be considered, applied, and integrated into the existing social welfare system that the district operates, and how to appropriately organize in the different social contexts [8]. Moreover, it is important to promote desirable results based on the participation of people in sub-districts which concur that disadvantaged seniors are an important target of disparity reduction and as a part of promoting related policies for sub-disadvantaged elderly people in Thai society.

2. Research Objectives

1. To analyze the inequality of social welfare received by the underprivileged elderly in the sub-district rural areas.

2. To apply the model of the social welfare system for the disadvantaged elderly which leads to the reduction of social inequality in the sub-district rural areas.

3. Research Materials and Methods

This research and development used mix-method design. In the quantitative study, the purposive sample was 200 underprivileged elderly people from 2,104 elderly people living in Tambol Makluea Kao, in accordance with the inclusion and exclusion criteria. The inclusion criteria are composed of 1) persons aged 60 years and over who lack the opportunity to access basic services or social welfare or 2) those who face any problems that make their lives difficult. The exclusion criteria are those who are unable to provide information or participate in activities throughout the research process. For the qualitative study, 8 governmental officers and 25 health care volunteers involved in providing social welfare to the elderly at the policy and operational levels participated in the process of testing the model by following the 4 principles of Ban Klang as shown in the research framework and provided information to answer research objectives in a small group discussion and an in-depth interview.

The research tools consisted of a questionnaire, small group discussion guidelines, and in-depth interview guidelines. The questionnaire employed in the quantitative study is composed of 2 parts. Part 1 is about general information, economic conditions, health status, and social welfare rights, totaling 23 items. Part 2 is about the elderly opinions on social inequality in 3 dimensions, totaling 55 items, 5 rating scale levels of social welfare expectation and access. The small group discussion and in-depth interview guidelines used in the qualitative study were for both governmental officers and health care volunteers in the process of exploring the context of social welfare management for the underprivileged elderly as mentioned in the research objective no.1. All research tools were the same as in the preliminary model and had already been verified for validity and reliability (Cronbach's Alpha Coefficient 0.853) by experts. Quantitative data were analyzed by paired t-test for pre-post of

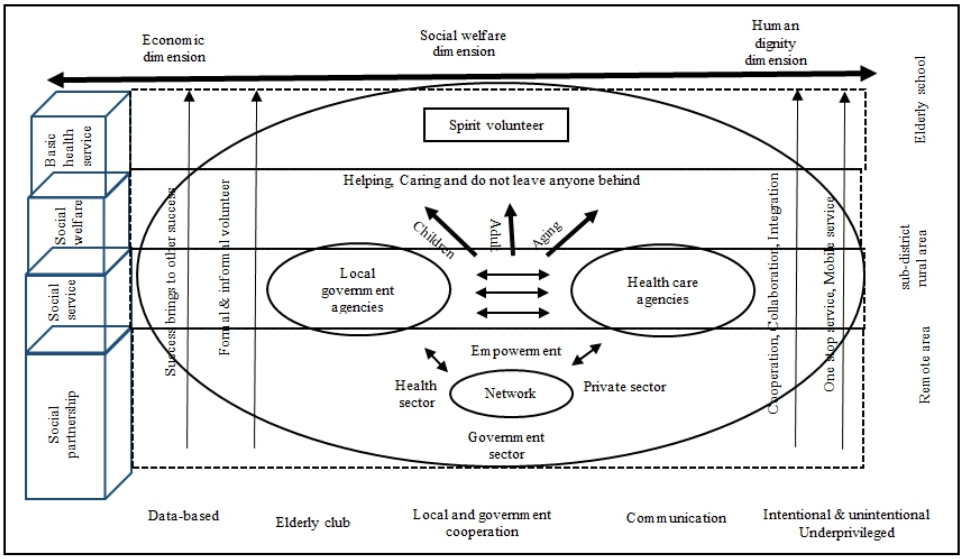

Figure 2: The model of the social welfare system for the disadvantaged elderly that leads to the reduction of social inequality in the extended area.

the model development. Content analysis was employed with qualitative data, under Certified Ethics of Bangkok Thonburi University, No. 1/2018.

4. Results

1. The inequality in receiving social welfare of the underprivileged elderly

1.1 Social inequality of disadvantaged elderly people

The result from the questionnaire showed that there were several underprivileged elderly people who were according to one or more characters of the 10 criteria for determined underprivileged elderly, between 5.9 – 7.0%, with the category of having income below the poverty line (88.2%), followed by chronic illnesses and inaccessibility to health insurance, and low income (8.1%), and no caregiver or abandoned, alone, and low income (1.6%), respectively.

1.2 The expectations and access/receive and needs for social welfare

The results from the questionnaire showed that there was no difference between the expectations and access/reception and needs for economic and social welfare aspects. The highest percentage of economic aspect was family members depositing money for the elderly, having enough money to spend when needed, and having sufficient money for spending in daily life. The highest percentage of social welfare aspect was having rights in using health insurance and maintaining health care, having the ability to search for health information, performing religious activities regularly, having their own residence, and being assisted with non-discriminate. In the human dignity aspect, the top three ranks in the aspect of having a legal status and the top three ranks of expectations for social benefits were different. In terms of the acceptance, the highest percentage were being accepted by family members, having rights and welfare access, holding ID cards, and receiving services from a community help center for the disadvantaged elderly.

2. The process of expanding the social welfare system for reducing social inequality for the disadvantaged elderly from the preliminary model to the extended area

The process of expanding the preliminary model to the extended area synthesized from the small group discussion and in-depth interview steps is as follows:

Stage 1: Transferring ideas and inspiration to organize an equal social welfare system. This stage is carried out through periodic workshops which aim to share ideas and inspiration at the local leader level on the foundation of the "Ban Klang" model. It is the process of comparing and sharing experiences between areas. The main findings in this stage are: 1) Creating value and sharing the meaningfulness of caring for the underprivileged elderly to live with dignity in later life. Giving them priority and attention with generosity, without neglect, and providing full assistance to meet their encountered needs are the concerns. 2) Helping the disadvantaged elderly attain success or fulfillment or achieve life goals. The importance is on encouraging disadvantaged elderly to live in their home or dignified areas by not bringing them to a foster home. 3) Taking care of and helping the underprivileged elderly with gratitude. Most elderly activities are continuously conducted by spirit volunteers, existing social capital, and local governments and aim to remind younger generations to look after the elderly. 4) A participatory process and knowledge sharing with a willing mind and the principle of not leaving anyone behind among networks. The networks at all levels are continually creating a sharing of knowledge on various occasions. Alliance, generosity, and dependent care are the most obvious practices. 5) The integration of various budgets in order to benefit the underprivileged elderly. The local governments support the budgets to create activities for the disadvantaged elderly. These activities are emphasized in helping them relieve loneliness, adjust their living conditions, manage health problems, and provide various basic welfare.

Stage 2: Finding key conditions and factors leading to do new or integrated projects and activities related to sub-district plans and policies. This stage is accomplished through the sorting of important persons who have communal ideas of mo-

bilizing resources that aim to enhance health and social welfare for the elderly. The conditions and factors can be summarized as follows: 1) expanding caregivers' role to provide support and care beyond merely routine work; 2) increasing the ability of spirit volunteers to profoundly and holistically take care of the elderly and help them access social welfare; 3) raising awareness of all the networks related to welfare provision; 4) developing teamwork through mutual support processes in order to achieve their purposes; 5) developing the quality of coordination and communication with all sectors with the same goal; 6) using empirical data and local technologies, then lead to be a community database; and 7) creating kinship community bonding through mutual trust, social responsibility, and confidence in leaders and local personnel.

Stage 3: Implementing projects and activities by all stakeholders. All factors and conditions are brought to implementation through workshops and training with the same objectives with the intention of expanding activities and leading to empirical results regarding the elderly. The acknowledgment, especially the medium to low levels of social welfare access, of the disadvantaged elderly is emphasized to all stakeholders. The defined inequality reduction activities by stakeholders are composed of: 1) activities that the underprivileged elderly can do by themselves, namely exercise, socialize with neighbors, etc.; 2) activities in which parties should partially support them to access social welfare, such as regular home visits and medication supervision by spirit volunteers, etc.; 3) activities in which parties should fully support them to access social welfare, including career promotion, arranging a shuttle to the hospital, etc.

3. The new model in the extended area of driving the equal social welfare system for the underprivileged elderly

This new model which was confirmed by the Tambol's involvements and experts is more prominent with respect to welfare and human dignity than the economic dimensions. The innovation results have mostly emerged from the work of spirit volunteers to help create morale and cultivate a way of thinking about doing good deeds, unity, and strong teamwork which resulted in a feeling of gratitude that existed in the community. 45 visiting plans have been newly developed, specifically consisting of social welfare and health need records. More stakeholders, like an elderly club, educational institutions, or soldiers, have joined to create various multi-dimensional ways or activities in many sub-district rural areas by integrating all sectors with cooperation in line with civil state guidelines and policies for improving the quality of life for the underprivileged elderly. The model of the social welfare system for the disadvantaged elderly that leads to the reduction of social inequality in the extended area is in figure 2:

4. Changing the inequality of underprivileged elderly people before and after the development of a social welfare system model in the extended area

Overall, social inequality among the disadvantaged elderly had decreased significantly. It means that they can access / receive services that are better in the economic, social welfare, and human dignity dimensions (average of access / service before model development = 1.59, average of access / service after model development = 1.84, p = 0.012), although the expectations for service access are insignificant (mean of service expectation before model development = 1.69, mean of service expectation after model development = 1.78, p = 0.098).

5. Suggestions

Policy proposals suggestions and guidelines for social welfare to sustainably reducing the inequality of the underprivileged elderly in sub-district rural areas are as follow:

1. Suggestions for the local government for helping the disadvantaged elderly

1) The elderly at the beginning age should be informed the importance of having savings and on how to access working capital for suitable career. Networking or partners such as the private sector may support them to find more possible job opportunities.

2) The health service units and spirit volunteers should provide regular health care for the underprivileged elderly, especially helping them to access health news and recreational activities.

3) The knowledge about rights, welfare, as well as knowledge of the necessary laws to obtain fair rights without discrimination should be continuously proposed to the disadvantaged elderly.

4) The sub-district plans for the underprivileged elderly should be specifically developed with an emphasis on capital strengths and cultural aspects of strong relative relationships.

5) The database of the disadvantaged elderly at the sub-district level should be built up from the empirical data. The data must show various dimensions of needs to be able to make comprehensive decisions, including linkage to relevant agencies for widespread use.

6) Continuously exchange learning with the sub-district networks to present the results of the extended area development. It helps to present the social capital, components, mechanisms, and working conditions of the area appropriately.

2. Suggestions for various sectors for supporting the extended area

1) The governmental officers in related sectors such as educational institutions should support the reliable data and be mentors in all processes of disadvantaged elderly development. This helps to respond to the national policy for developing the quality of life of this group and preparing other age groups to effectively become the active elderly.

2) Personnel or organizations involved in the welfare of the elderly should coordinate with local workplaces by using their expertise to maximize the benefit social and health benefits and allow agencies to use their potential to reduce disparities for the disadvantaged elderly.

3) It is suggested to strongly support the formulation of strategies with budget allocation for the development of the disadvantaged elderly. In addition, the defined activities and technical assistance must be carried out with clear responsibilities. This will help to fulfill the work drive and develop innovations to concretely reduce disparities and enable continuous operations.

Table 1. Expectations and access / social welfare of the disadvantaged elderly before and after model development.

Expectations and achievement / Receive social welfare for the disadvantaged elderly	Before developing the model				After developing the model				Compare before and after the model development	
	Expectation (n=185)		Achievement (n=185)		Expectations (n=185)		Achievement (n=185)		Expectation	Achievement
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Sig.	Sig.
Dimension of economic inequality										
1. Employment and income	3.89	6.963	2.39	4.725	6.63	8.074	4.47	6.979	0.000	0.000
2. Saving	2.46	2.906	2.20	2.773	5.48	3.511	1.93	2.479	0.000	0.271
3. Spending	3.51	3.935	3.27	3.583	7.52	5.377	3.87	4.598	0.000	0.075
Dimension of social inequality										
1. Welfare of the underprivileged elderly	9.21	9.718	9.34	8.547	13.31	17.799	10.96	13.08	0.000	0.035
2. Health	23.26	9.131	22.61	9.118	22.29	12.977	24.11	11.803	0.581	0.033
3. Education and information	5.89	6.233	8.71	5.895	5.87	7.389	11.41	7.126	0.000	0.000
4. Self-development participation in social and recreation activities	21.22	16.58	10.31	16.546	20.58	19.782	9.54	21.558	0.002	0.314
5. Resident	5.66	4.871	7.68	4.737	4.46	6.241	9.02	6.195	0.595	0.021
6. Judicial process	0.87	2.308	0.76	1.887	4.23	5.075	4.20	4.935	0.000	0.000
Dimension inequality in human dignity										
1. Acceptance	8.16	2.176	7.92	2.436	4.56	3.878	6.53	3.516	0.000	0.000
2. Having a legal status	10.76	6.083	11.30	5.683	7.56	7.637	10.89	7.249	0.000	0.445
3. Discrimination	8.93	3.969	8.97	3.979	5.84	5.347	9.29	5.456	0.000	0.452
Total	1.69	1.210	1.59	1.120	1.78	1.694	1.84	1.53	0.098	0.012

6. Discussion

1. When comparing the development of underprivileged elderly leading to reductions in social inequality between the previous model and the synthesized model obtained in this study, it can be obviously seen that the important factor that makes the underprivileged elderly have more access to social welfare is the involvement adhere to communication and implementation of concepts and methods related to social inequality reduction through horizontal and vertical operations, which rely on mechanisms of deploying policy to practical management continuously. The working concept in social welfare for the underprivileged elderly is "care for each other and leave no one behind." It is an important foundation of local development that leaders consistently value and encourage practitioners to participate, as well as raising awareness among all local people to have the love for their homeland and to jointly share the idea. It can be seen that local leaders have the characteristics of both transformational and exchange leadership or transactional leadership style. These kinds of leaders are people with vision and strategy drive. They can cultivate an organizational culture of generosity and good deeds while encouraging workers to create their own works, social products, and new local technology. They also have the ability to create common values and build good relationships causing activities in the local area to have meaning in terms of virtue and build understanding with common feelings between workers. While using the exchange leadership of listening and sharing ideas with the workers in order to achieve the specified objectives or perform duties as needed by creating motivation to work with a variety of formats, they are able to make local operations run smoothly and efficiently, showing expertise in accordance with management functions, whether these refer to planning, personnel management, budget allocation, monitoring, or control of work completion, etc. [9].

2. This driving force leading to the reduction of social inequality is evident from the comparison of changes after the social welfare system development, which found that the elderly have more access to services, resulting in improved economic, social welfare, and human dignity. The result of various activities designed to promote access to services for disadvantaged elderly is based on continuous analysis of the problems and needs, including follow-up, improvement, and evaluation of activities by spirit volunteers and other sectors. This is similar to the quality management cycle (Plan-Do-Check-Act: PDCA) that helps to systematically operate with the goal of continuous development. Each activity for helping the underprivileged elderly will be planned in a complete rotation. This is the driving force for the next cycle of operations and can be continuously improved [10]. The work plan includes the objectives, scope of work, assignment of responsibilities, and ultimate goals. The determined activities are logically identified by social and health problem assessment processes, which makes it possible to give specific advice or assistance. In checking the work results, spirit volunteers will report and visit homes of the underprivileged elderly. After that, plans for the next visit to further improve the work of the spirit volunteers will be conducted. In this way, problems and needs in the activities that volunteers promote for the elderly access to services can be seen and they can respond to or solve these problems and needs immediately or notify the relevant parties for help. As for the problems or needs that spirit volunteers

cannot address or solve immediately, even by informing those involved, these will still take time to resolve as they may be related to certain procedures that have to be pending, waiting for documentary evidence, or waiting for budget approval. This is consistent with the results of the quantitative study which found that saving, spending, social participation, legal status, and discrimination are not significantly changed when comparing mean scores before and after the model development. It can be explained that activities conducted by volunteers and other concerned parties were not able to reduce the inequality in short in the economic dimension of saving, social welfare in self-development, participation in social and recreational activities, and human dignity in relation to legal status. These aspects are involving with the complex life experiences of underprivileged elderly which build up through different ways of life.

3. One of the success factors that leads to the social inequality reduction for the elderly is social capital which includes traditions, culture, and religious doctrine. This is the local way among people in the community to support each other. The care system both in the form of volunteering and supporting to each other formed a mix of horizontal capital (bonding or horizontal) which means all groups in the sub-district felt equal, and vertical capital (bridging) which means people of all ages respect each other. This enables the use of structural and cognitive social capital to benefit the disadvantaged elderly. The structural social capital is a factor that helps various departments in communities and social networks to work with common goals through the roles that each party is responsible for. The cognitive social capital, on the other hand, helps convince people in the community to see in the same direction of the importance of norms, values, attitudes, and beliefs about caring for the underprivileged as valuable people [11]. Being a traditional society and kinship and having a close relationship results in both formal and informal working systems that promote each other; moreover, personnel are local people or nearby locals. This results in collaborative thinking, especially in the human resource group that is directly related to the care for the underprivileged elderly. The disadvantaged elderly club, the hospital, and the Sub-district Administrative Organization, which are a traditional society and a kinship system, make the people in the community feel that there are blood relations or closed relationships or belonging to one family. This makes social organization in matters that concern various departments in the community come about more easily. Therefore, the kinship system is a mechanism for grouping, defining flexible status, and role building as a learning system; and social values based on the same local context is the heart of relationships building in a society that leads to the development, support, and cooperation of people in all communities [12].

4. Spirit volunteers are considered an important mechanism for reducing social inequality and have been developed to have a capacity similar to that of health volunteers and caregivers, resulting in academic fulfillment in addition to the ability to take care of the existing psychological remedies for the underprivileged elderly. This helps to strengthen people and lets them be ready to work alongside the volunteers and the caregivers. At the same time, spirit volunteers are also complemented by helping mind to treat the underprivileged elderly. Consequently, spirit volunteers are a caring group who are ready to help and fulfill social and psychological needs because they are well trained. That training equipped them with the healthcare knowledge and psychological healing skills to be able to work, and it gives them the confidence to use their abilities and skills to provide assistance to the underprivileged elderly. The collaboration among spirit volunteers and the caregivers enables them to exchange experiences, which is a behavior that causes the sharing of experiences and allows knowledge to be circulated for development. Knowledge sharing is one of the factors that leads to learning among everyone involved and helps to increase the efficiency of aid for the underprivileged elderly [13]. This exchange of learning is a process in which spirit volunteers and caregivers voluntarily share knowledge, skills, and experiences through social processes. The exchange of knowledge consists of the transfer of knowledge that volunteers and caregivers have given a chance to each other to understand and receive or absorb the knowledge of their own [14 - 16].

7. Conclusion

The social welfare system model for social inequality reduction of the elderly is applied in sub-district areas. The process of expanding the preliminary model to the extended area is composed of transferring inspiration to re-organize equality social welfare systems, finding key factors that leading project/activities implementation by all stakeholders. The new model is more prominent with respect to the dimensions of welfare and human dignity that emerged from the work of spirit volunteers to help create morale and cultivate strong teamwork.

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Competency of non-formal education teachers

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Abstract

The research aims to (1) study the needs and necessities of non-formal education teachers in order to develop learning management competency by studying the documents and research related to teacher competency, non-formal education teachers, 21st-century learning competencies, and lifelong learning competencies; (2) survey the competency of non-formal education teachers. The research sample consisted of administrators and teachers of Offices of the Non-Formal and Informal Education (NFE) in 5 regions, including 6 representatives of teachers in each region, totaling 30 people and 2 representatives of administrators per region, totaling 10 people, totaling 40 people. The research instruments are document analysis, the 5-level rating scale questionnaire on learning management competencies of non-formal education teachers and open-ended questions. The findings show that the highest competency is morality, ethics and professional ethics 93.8%, team working competency 90.2% and the lowest competency is knowledge and ability 82.4%.

Keywords: Learning management competency, non-formal education teachers

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1. Introduction

"Competency" refers to behavioral attributes that result from knowledge, skills, abilities, and other attributes that are hidden within a person, such as values, ethics, personality, character, self-concept, and motivation. These traits drive a person to behave and to perform duties and responsibilities or situations effectively that exceed the criteria or goals as well as create outstanding works [1-3]. These are necessary and consistent with the organization's suitability [4]. Therefore, the competency model should be established for each profession [5]. The model could be used as a framework for management direction and formulate organization and personnel development strategies in order to operate in a direction that is consistent with the policies of the country and the organization.

Teachers are an important mechanism for driving learning process and citizen potential development as the word "Good Teachers" is the person who creates "Good People" in Thai society [6]. The National Education Act 1999, Section 52 requires the Ministry to promote the system and production process, as well as develop good quality and standardized teachers and educational staff as "high-profession" by directing and coordinating educational institutions for producing, developing and strengthening novice teachers and educational staff, including continuing professional development for experienced teachers and staff [7]. Therefore, promoting the development of quality teachers and educational staff is an important necessity.

Regarding the study of the Thai teacher professional standards (Teachers' Council of Thailand: "Khurusapha" (KSP)) and Thai teacher competency (National Institute for Development of Teachers, Faculty Staff and Educational Personnel (NIDTEP)), it can be concluded that the competency of teachers and educational staff consists of (1) 5 main competencies: (1.1) job performance, (1.2) good service, (1.3) self-development, (1.4) team working, and (1.5) morality and professional ethics; and (2) 6 operating competencies: (2.1) curriculum and learning management, (2.2) learner development, (2.3) classroom management, (2.4) analysis, synthesis and research for learner development, (2.5) leadership, and (2.6) community engagement for learning management [8].

Furthermore, technology plays huge roles in today education and teachers should have 21st century learning competencies. Regarding the educational reform policy under the National Education Act (1999) which promotes and supports lifelong learning and learning society, teachers should have lifelong learning and self-directed learning competencies.

Thailand focuses on non-formal education to enhance and expand educational opportunities, as there are still many people who are unable to access the formal education system. Non-formal education allows students to receive quality and thorough education, able to further develop in higher grades while working regardless of learners' limitations [9].

Equitable Education Fund (EEF) surveyed in 2019 and found that 7.3 million Thai students which is over half of total school-age group population dropped out of the informal education system [10]. Moreover, the coronavirus pandemic (COVID-19) pushed more children out of school because of the economic crisis [11]. Poverty students have to work or work in replace of their parents [12]. School reports showed around 21.1% of students do not want to continue studying in schools [13] and estimated that in 2020 the number of students dropped out of the education system may increase [14].

Youth leaving school or no education have an impact on Thai

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economic in which Thai labors are less effective, 3 times lower than Malaysia. In contrast, if the education covers across country, it increases 3% Gross Domestic Product (GDP) [14]. Out of school children may cause other social problems. Information from United States of America shows that this group of children likely causes social problems 7 times more and approximately live 9 years shorter than informal students [15-16].

Non-formal education seems to solve this problem however it could not be success due to the ability of teachers. Non formal teachers have many duties such as looking after several classes while some lack the curriculum understanding [17]. Wanawee Boonkoum [18] informed that teacher competency development will improve capabilities and good result will direct to students.

The purpose of education in this era is to create innovators to change teacher's competency. Teachers should have 21st century skills too. In addition, Phrakhrusutaworathammakit and Phramaha Pongtaratid Sutheero [19] said not only 21 century skills, but teachers also required lifelong learning skills. It supports abilities and teaching skills of teacher up to date. The competency of non-formal teachers includes 21st century skills and lifelong learning skills.

Non-formal education teachers, persons who teach people, create continuous lifelong learning opportunities for people of all ages, manage leaning in order to upgrade education level of people, develop reading literacy, arrange continuing education and develop learners to be lifelong learners even if they are not in the school system [20-21]. These enable Thais can develop themselves, improve quality of life, see through current changes, be good citizens which will lead to be learning and wisdom society as well as develop the ability to compete with other countries [22].

As mentioned above, non-formal education teachers perform important roles in promoting lifelong learning for people of all ages. Therefore, it is essential to survey study on competency of non-formal education teachers in order to develop their teaching quality which will lead to prepare readiness of Thai people in current situations; information age, rapid and drastic changes in economy, society and politics.

Objective: To study non-formal education teachers' needs in the point of developing competency.

2. Methodology

1. Review and study documents and research papers related to core competency of teachers and non-formal education teachers, 21st century learning competency and lifelong learning competency.

2. Survey needs and problems of non-formal education teachers in the point of developing competency.

2.1 Participants

Research population

77 Offices of the Non-Formal and Informal Education (NFE) in Thailand

Sample group

Administrators and teachers of NFE in 5 regions; North, Northeast, Central, Eastern, and Southern, 6 teacher representatives per region, totaling 30 persons and 2 administration representatives of per region, totaling 10 people, sum totaling 40 people

2.2 Data collection and analysis

Instrument for data collection

The questionnaire on learning management competencies of non-formal education teachers was used to collect the data and was developed by studying related research and the IOC results from experts. The questionnaire was divided into 3 parts; (1) questions on general information of the respondents (2) 5-rating scale questions on the learning management competency and (3) recommendations on the competency.

Data collection

The questionnaire was sent and responded via e-mail and Google From.

The Scale

The data from all completed questionnaires were statistical analyzed, according to the specified criteria. The average score (Mean) was used to display the majority of people opinions. The mean of 3.50 and above were accepted criteria in the study. The findings were summarized in order to be the desired learning management competency of non-formal education teachers.

3. Results

From the document and research analysis on core competency of teachers and non-formal education teachers, 21st century learning competency and lifelong learning competency then the synthesis on competency of non-formal education teachers, these can be concluded that lifelong learning competency refers to the behavior of individuals demonstrating their ability to learn throughout their lives which consists of 6 competencies; (1) basic knowledge (2) media, information usage (3) knowledge acquiring and self-development (4) learning exchange and team working (5) community engagement (6) analytical thinking and innovation creating.

In the point of teacher competency in the 21st century can be summarized that it consists of (1) basic knowledge (2) media, information usage (3) continuing self-potential development (4) team working, colleagues and community assistance (5) community engagement (6) classroom management and learning evaluation (7) leadership (8) ethics and morality of teacher profession.

From the Table 1, it can be summarized into 7 categories as follows; (1) Knowledge and ability competency (2) Ethics and morality of teacher profession competency (3) Learning management competency (4) Continuing self-potential development competency (5) Leadership competency (6) Analytical thinking and innovation creating competency and (7) Teamworking and community engagement competency.

From the Table 2, the results from the document analysis were used to conduct a survey questionnaire on the needs of non-formal education teachers in developing their learning management competency. It was found that non-formal education teachers need in developing teaching and learning; basic knowledge, continuing self-potential development, analytical thinking and innovation creating, learning management, leadership, teamworking and community engagement and ethics

Table 1. Comparison table between lifelong learning competency and teachers' competency in 21st century.

Items	Lifelong learning competency	Teachers' competency in 21st century
1	Basic knowledge	Basic knowledge
2	Media, information usage	Media, information usage
3	Knowledge acquiring and self-development	Community assistance
		Community engagement
4	Learning exchange and team working	Classroom management and learning
		Evaluation
5	Community engagement	Leadership
6	–	Ethics and morality of teacher profession
7	–	
8	–	
9	Analytical thinking and innovation creating	

Table 2. Table of the percentage of needs assessment learning management competency of non-formal education teachers. (N = 40)

Learning management competency	Percentage of needs assessment
Knowledge and ability competency	82.4
Continuing self-potential development competency	86.2
Analytical thinking and Innovation creating competency	86.2
Learning management	86.4
Leadership competency	87.2
Teamworking and community engagement competency	90.2
Ethics and morality of teacher profession competency	93.8

and morality of teacher profession. The results on teachers' needs in developing their competency, the highest competency is ethics and morality of teacher profession representing 93.8%, teamworking competency 90.2% and the lowest competency is knowledge and ability 82.4%.

3.1 Results and Discussion

From the survey of the needs of non-formal education teachers in their competency development, it was found that the competency that the teachers need for teaching and learning were knowledge and ability, which can be discussed as follow; the competency that should be developed are: (1) the ability to create or develop learning subject groups that are consistent with the core curriculum and local area appropriately, (2) expertise in content in order to manage learning and the ability to determine learners' learning outcomes to think analytically, synthesize, and apply in accordance with the differences and nature of learners. This is consistent with Duchanee Piyapong [23] found that non-formal education teachers need to expand their abilities to efficiently manage teaching. The abilities include self-study, lifelong learning, knowledge, attribute and ethical values in order to improve teacher's learning competency. Moreover, Muhammad Ali Wate [24], which conducted a study on "The Desirable Competency of Non-School Education Volunteer Teachers in Pondok" it was found that the problem of non-formal education teachers in Pondok education institutions was the lack of knowledge and understanding about the non-formal education curriculum. and writing integrated lesson plans, lack of skills in organizing the learning process various teaching techniques especially teaching with an emphasis on student-centered and thought-provoking and teachers who do not have graduated teacher qualifications, no qualifications in the subjects taught and is not good at the main subject. Furthermore, the research results of Pornpipat Suesat [25] found that the problem of providing learning services was the most problematic, followed by supporting activities in the community and society, culture, traditions, building learning networks. in planning for lifelong learning management and learning activities, respectively, which is consistent with Siriprapha Longphimai [26] presented in the study "Development of guidelines to enhance teacher competency in learning management under non-formal and informal education center in Maha Sarakham Province". It was found that the teacher's competency in learning management, it was at a moderate level in all aspects which can be sorted from highest to lowest average as follows; learning management that focuses on learners, the mean was equal to the measurement and evaluation of learning, followed by learning design which is equal to media and innovation for learning management. However, if considering the desirable conditions for enhancing teacher competency learning management, only the learning design aspect was at the lowest level, is lower than the other competency.

Therefore, non-formal education teachers are necessary to develop knowledge competency, especially instructional design, curriculum development for learning subject groups and local curriculum regarding raising appropriate learners' potential in thinking, analyzing, synthesizing and applying for themselves, local area and community.

In the point of highest competency, morality and ethics, this is consistent with the study of Jiradej Klakhayan [27] which

found that the current state of competency in expertise of non-formal teachers Kalasin Province were at a moderate level, however, only the morality and ethics competency was at a high level. This is also consistent with Achiraya Yamtub, Kulchalee Chongcharoen and Chouchat Phuangsomchit [28] studied in the title "Ethical Leadership Capabilities of administrators affecting the effectiveness of educational institutions", which studied with formal education teachers in Nonthaburi province. It was found that; (1) the ethical leadership competency of the administrators was at high level (2) the moral leadership competency of the administrators and the effectiveness of the educational institutions, was at high level of positive correlation with statistical significance at .01 level (3) ethical leadership competency of the administrators affecting educational institution effectiveness, i.e., concerning public interest rather than personal benefits, compliance with standards, moral and ethical sensitivity.

Furthermore, there are more formal strategies which supports on the morality and ethics competency, (1) Government Teacher and Educational Personnel Regulation Act (2004) which has established guidelines, priorities, and basic criteria for teacher competency. It strengthens morality, and professional ethics which is proper personality performance of teachers as well as being good role model for colleagues, students and community [29], (2) the Teachers Council's regulation on professional ethics 2013 in the category of professional ethics, article 28 states that educational professionals must have faith, honesty, responsibility for their professions, and being good members of the professional organization [30]. This regulation is part of ethics for teacher professional standards in order set patterns of behavior for persons who are in educational profession including those who practice professional education which aimed to maintain and promote honor, reputation and educational professional status, for being trustworthy to service recipients and society. These include desirable behaviors of teachers, such as showing appreciation and faith in the values of the profession, maintain reputation and protect professional dignity, praise and honor those whose professional achievements are known to the public.

4. Conclusion

From the documents analysis and competency survey, discovered that non-formal education teachers need to develop learning management competency. The findings show that the highest competency is morality, ethics and professional ethics, team working competency and the lowest competency is knowledge and ability.

4.1 Recommendations

From the study, it was found that the learning management competency is the lowest mean. This result presented that the need of non-formal education teachers was in improving their ability to create or develop appropriate curriculum for learning subject groups and local curriculum. Therefore, NFE should focus on the development of non-formal education teachers in terms of curriculum and local curriculum as the first priority because teaching management is the process of transferring knowledge and various developments of learners, which will develop learner quality correctly according to the knowledge, local conditions, and learners' abilities.

In addition, their competency should be monitored periodically in order to develop and improve the competency of non-formal education teachers for maintaining teaching quality and sustainable self-competency development.

For further research, researchers should study developing specific learning management performance. Study the factors that influence or motivations for enhancing the learning management competencies of nonformal education teachers.

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A causal relationship structure model of dietary behavior to control blood glucose levels of type 2 diabetes mellitus patients

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Abstract

This cross-sectional study research aims to test a causal relationship structure model of dietary behavior to control blood glucose levels of type 2 diabetes mellitus patients by developing elements from the theory of planned behavior and the self-efficacy theory. The study group consisted of 350 people with type 2 diabetes mellitus, aged between 40-59, who received medical care at Pathum Thani Hospital, Pathum Thani Province. Participants were selected by simple random sampling with a computer program to write random commands from random numbers. The instrument used for the study consisted of demographic data, a questionnaire to investigate the perceived behavioral control, intention to perform the behavior, self-efficacy to diet, and dietary behavior to control blood glucose levels questionnaire. Data were analyzed with descriptive statistics and a computer program AMOS to analyze structural equation models (SEM).

The study results revealed that a causal relationship structure model of dietary behavior to control blood glucose levels of type 2 diabetes mellitus patients fit with the empirical data and could explain 83% of the variance in dietary behavior to control blood glucose levels affecting blood sugar levels. Dietary behavior to control blood glucose levels had a direct negative effect on glycated hemoglobin levels (HbA1c) ($\beta = -0.91$, $p < .05$). The perceived behavioral control, self-efficacy to diet, and behavioral intention had a positive direct effect on dietary behavior to control blood glucose levels respectively ($\beta = 0.55$, $p < .05$; $\beta = 0.50$, $p < .05$; $\beta = 0.31$, $p < .05$). In addition, variables with an indirect effect on dietary behavior to control blood glucose levels through behavioral intention were self-efficacy in diet and behavioral control respectively ($\beta = 0.30$, $p < .05$; $\beta = 0.27$, $p < .05$).

The study concludes that the perceived behavioral control, self-efficacy to diet, and intention to perform the behavior directly affected dietary behavior to control blood glucose levels of type 2 diabetes mellitus patients.

Keywords: Causal relationship structure model, dietary behavior, control blood glucose levels, type 2 diabetes mellitus patients

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1. Introduction

Type 2 diabetes is a condition in which the body has high blood glucose levels. It is considered a public health problem since 2017, there were 425 million people with diabetes worldwide, while Thailand had 4.8 million, accounting for 8.9% of the total population. It was also found that 77.9% were unable to control HbA1c levels below 7% to achieve the target [1]. For Pathum Thani Province, it was found that diabetic patients could not control blood glucose levels in their blood, and the mortality rate of diabetes in the age of 40-59, the 4th health zone, is the highest due to the lack of health behaviors to take care of themselves. Therefore, there is a high risk of complications and premature death, consisting of 6.3% of total deaths proportional to an economic impact worth up to 24,489 million baht [2].

Factors affecting glycemic control were behavioral, psychological, motivational, and biosocial factors [3] especially dietary behavioral factors that had the greatest effect on blood glucose levels, which were able to reduce HbA1c by 1.0 – 2.0% [4]. The most effective prevention of complications is to consume sugar-free food to control blood glucose levels, eat food in the right amount, not exceed the amount of energy that should be received, and choose to eat the right types of food [5]. The key factors that had a high influence on food consumption behavior were intention to practice, behavior control perception and practical ability, which are variables from the concept of planned behavior theory and the theory of self-efficacy. This theory supports that these factors have high power in predicting health behaviors [6, 7] .

Guidelines for modifying dietary habits in diabetic patients, group processes and social support are used. Inspiration for self-regulation, education to promoting awareness of risk and severity of disease, perceived benefits and leads to action [5]. The approach has several variables involved. Event activities cannot be multiplied or service-intensive in food consumption in the context of a tertiary hospital. As a result, patients with type 2 diabetes mellitus cannot control their blood glucose levels. To promote dietary behaviors to control blood glucose levels, it is necessary to understand the causal factors of behaviors that will support or inhibit dietary behaviors for proper blood glucose control. Therefore, the researcher is interested in studying the causal relationship structure model of food consumption behavior to control blood glucose levels in patients with type 2 diabetes mellitus.

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2. Research Objectives

To examine a structural causal relationship model of dietary behavior for glycemic control in patients with type 2 diabetes.

Specific objectives

1. To demonstrate the relationship between dietary behavior for glycemic control and level of glycated hemoglobin (HbA1c).

2. To explain the relationship between perceived behavioral control, self-efficacy to diet, intention to perform the behavior, and dietary behavior to control blood glucose levels.

3. To prove the relationship between perceived behavioral control, self-efficacy to diet, intention to perform the behavior, and dietary behavior to control blood glucose levels.

3. Hypothesis

1. Dietary behavior for glycemic control has a direct negative influence on the level of glycated hemoglobin (HbA1c).

2. Perceived behavioral control, self-efficacy to diet, and intention to perform the behavior are direct positive influences on dietary behavior to control blood glucose levels.

3. Perceived behavioral control and self-efficacy to diet indirectly influence dietary behavior to control blood glucose levels through the variables of intention to perform.

4. Research Conceptual Framework

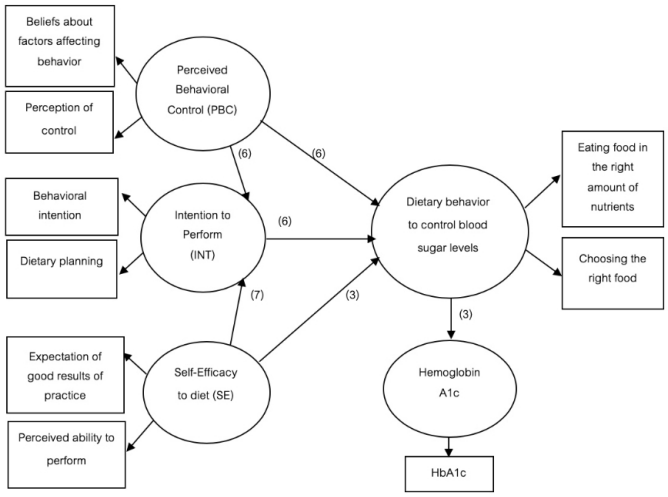

Figure 1: Research Conceptual Framework.

5. Research Methodology

This research is a cross-sectional study using Structural Equation Modeling (SEM) to examine a structural causal model of dietary behavior for glycemic control in type 2 diabetes patients in a period of three months.

5.1 Population and sample

The population in this study was 1,683 type 2 diabetic patients, aged 40-59, who attended outpatient diabetes clinic at Pathum Thani Hospital, Pathum Thani Province.

The sample size criteria were used for the analysis of Hair JF (2010) [8] Structural Equation Modeling (SEM). To determine the minimum sample size, i.e., latent variables < 7 variables, and each latent variable was measured from observable variables < 3. Variables (under-identified latent variables) have a minimum sample size of 300 individuals. Therefore, this study estimated the sample size requirement of at least 300 subjects. To deal with missing data exceeding 15% or more than 45 people, there were different conditions so a sample size of 350 people was determined. After that, a simple random sampling was performed by using a computer program to write a command to randomly pick the data from the samples from 350 people [8] .

5.2 Research tools

The data collection tools of this study were questionnaires consisting of 9 questions about general information, 14 questions about intention to perform, 14 questions about perceived behavioral control, 28 questions about self-efficacy to diet, and 19 questions about dietary behavior to control blood glucose levels.

5.3 Quality testing

The instruments used in the research were examined for the validity of the content by 5 experts. The intention to perform a behavior questionnaire, the perceived behavioral control questionnaire, the self-efficacy questionnaire, and the dietary behavior for glycemic control questionnaire received the IOC (Index of item Objective Congruence) of 0.6 – 1.0 and the coefficient of alpha Cronbach was calculated. The confidence values were .94, .94, .97, and .89 respectively.

5.4 Protecting the rights of informants

This research has been certified in human research ethics of Pathum Thani Hospital, Pathum Thani 0032.203.3/22159 and Kasetsart University COA63/034. Regarding the protection of information providers' rights, the researcher explained the research objectives, the right to answer or to not answer any questions, the right to terminate cooperation, and confidentiality to not immediately disclose confidential information or information that could damage and destroy raw data upon completion of the data analysis. Once the informant was willing to participate in the research, a consent form was signed.

5.5 Data collection

1. Submit research ethics in humans at Pathum Thani Hospital and Kasetsart University.

2. Request a certificate from the Dean of Faculty of Education, Kasetsart University and Director of Pathum Thani Hospital, Pathum Thani Province to clarify the purpose of collecting information.

3. Call on the sample and ask for cooperation in data collection.

4. Verify completeness of data for the incomplete part, ask the sample group to complete the answer.

Table 1. Parameter values, weight composition of variables in a causal relationship model of dietary behavior for glycemic control (n = 350).

Variable	Element weight				
	E	**Std, Coefficient (β)**	**SE**	**t**	**R2**
Intention to perform the behavior (INT)					
1. behavioral intention	1.054	0.922*	0.035	29.114	0.875
2. dietary planning	1.000	0.930*			0.824
Perceived behavior control (PBC)					
1. beliefs about factors affecting behavior	1.058	0.945*	0.033	32.124	0.894
2. perception of control	1.000	0.923*			0.852
Self-efficacy (SE)					
1. perceived ability to perform	1.033	0.952*	0.035	29.087	0.906
2. expectation of good results of practice	1.000	0.917*			0.840
Dietary behavior to control blood sugar levels (DIET)					
1. eating food in the right amount of nutrients	1.000	0.907*	0.043	11.929	0.824
2. choosing the right food	0.510	0.630*			0.420
Hemoglobin A1c (HbA1c)					
A1C: Hemoglobin A1c	-0.306	-0.909*	0.012	-24.884	0.827

*Statistically significant at the level .05

5.6 Data analysis

1. Preliminary analysis of data using a ready-made statistical program consisting of frequency, percentage, mean, and standard deviation.

2. Examination of the causal relationship structure of food consumption behavior for glycemic control in type 2 diabetic patients analyzed by using AMOS software program with Structural Equation Modeling (SEM) method.

6. Results

The general characteristics of the sample were 30.60% male and 69.40% female, with a mean age of 52.83 (SD=5.98). Most had a body mass index of 23.1-29.9%. 50% had the highest education at the primary school level. 54.60% had an average income of less than 10,000 baht per month. 41.40% of the sample being diabetic for 4-6 years, 30.60% taking tablet drugs to treat diabetes, 98.9% being with diabetes complications, and 16.0% having the mean level of glycated hemoglobin (HbA1c) at 8.5. For the intention to perform the behavior, the perceived behavioral control, self-efficacy and dietary behavior to control blood sugar levels, most were at the moderate level of 55.40, 52.90, 45.40 and 47.10% respectively.

Regarding method of parameter estimation, the composition weight of related variables in the causal relationship model of dietary behavior for glycemic control in type 2 diabetes patients was found. The intention to perform the behavior (INT) consist of behavioral intention (β = 0.922, p< .05) and dietary planning (β = 0.930, p< .05). The perceived behavioral control (PBC) include beliefs about factors affecting behavior (β = 0.945, p< .05) and perception of control (β = 0.923, p< .05). The self-efficacy (SE) are made up of perceived ability to perform (β = 0.952, p< .05) and expectation of good results of practice (β = 0.917, p< .05). The dietary behavior to control blood sugar levels (DIET) are composed of eating food with the right amount of nutrients (β = 0.907, p< .05) and choosing the right food (β = 0.630, p< .05). Finally, the accumulated sugar levels in the blood (HbA1c) comprises of accumulated sugar in the blood (β = −0.909, p< .05) (Table 1).

Through the analysis of the linear structural relationships, the causality model of consumer behavior is determined. It was discovered that the control of blood glucose levels in type 2 diabetic patients showed the absolute fit index of χ^2 = 4.842, df = 7, p-value = 0.679, RMR= 0.001, RMSEA = 0.001, GFI = 0.997. The incremental fit index showed NFI = 0.999, TLI = 1.003, CFI= 1.000, and parsimony fit index indicated that AGFI = 0.980, PNFI = 0.194. χ^2/df = 0.691. The consistency index of the model shows that all the results pass the criteria of the absolute fit index, incremental index, and parsimony fit index, which means that the causal relationship model of glycemic control and dietary behavior in patients with diabetes mellitus harmonies with empiricism and matriarchy. The effects of variables in the model are shown in Table 2.

When considering the model elements from direct and indirect variables affecting dietary behavior for glycemic control and blood glucose levels in patients with type 2 diabetes, it was concluded that the causal structure model was able to co-describe dietary behaviors for glycemic control affecting the glycemic index by 83% with a direct negative influence on the level of glucose in the blood, which was dietary behavior to control blood sugar levels (β = −0.91, p< .05). The perceived behavior control, self-efficacy, and intention to perform the behavior had a direct positive influence on food consumption behavior for glycemic control (β = 0.55,p< .05; β = 0.50,p< .05; β = 0.31,p< .05, respectively), and variables that indirectly influence food consumption behavior to control blood sugar levels through the variable of intention to perform were the self-efficacy to diet (β = 0.27,p< .05) and perceived behavioral control (β = 0.30,p< .05) (Table 2). Therefore, the causal

Table 2. Statistical values of the influence analysis of variables and the conformity index in the causal model of dietary behavior for glycemic control in patients with type 2 diabetes mellitus.

Variable	INT			DIET			HbA1C		
	DE	IE	TE	DE	IE	TE	DE	IE	TE
SE	0.88*	-	0.88*	0.50*	0.27*	0.77*	-	-0.70*	-0.70*
PBC	0.97*	-	0.97*	0.55*	0.30*	0.85*	-	-0.78*	-0.78*
INT	-	-	-	0.31*	-	0.31*	-	-0.28*	-0.28*
DIET	-	-	-	-	-	-	-0.91*	-	-0.91*

χ^2 = 4.842, df = 7, p-value = 0.679, SRMR= 0.001, RMSEA = 0.001 , GFI = 0.997, NFI = 0.999 ,TLI = 1.003, CFI = 1.000, AGFI = 0.980, PNFI = 0.194, χ^2/ df = 0.691

*Statistically significant at the level .05

Note.

PBC = Perceived behavior control

SE = Self-efficacy to diet

INT = Intention to perform the behavior

DIET = Dietary behavior to control blood sugar levels

HbA1C = Accumulated sugar levels in the blood

DE = Direct effect

IE = Indirect effect

TE = Total effect

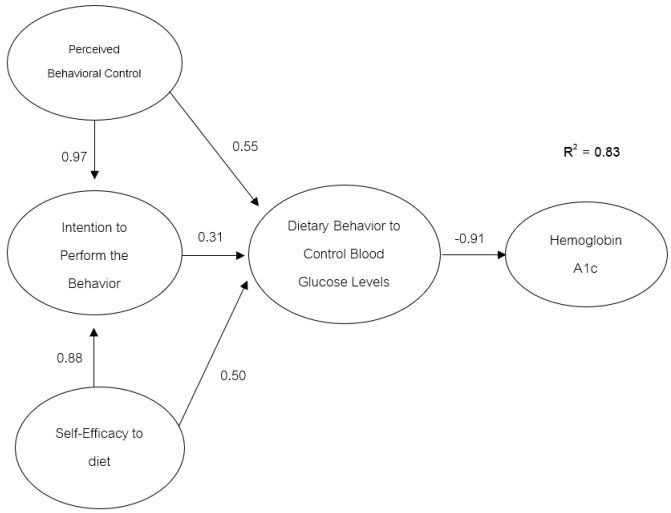

Figure 2: A causal model of dietary behavior for glycemic control in type 2 diabetes patients.

relationship structure model of dietary behavior for glycemic control in patients with type 2 diabetes was harmonized with empirical data and could theoretically explain the relationship between the variables. This is in accordance with the research hypothesis (Figure 2).

7. Conclusions and Discussions

The causal relationship structure model of dietary behavior for glycemic control in patients with type 2 diabetes was harmonized with empirical data and can contribute to explaining food consumption behaviors to control blood sugar levels affecting blood sugar levels by 83%. Dietary behaviors that control blood sugar levels have a direct negative influence on blood sugar levels. Consistent with previous studies, it was found that dietary behavior had a negative influence on blood sugar levels in patients with type 2 diabetes and had the best hypoglycemic effect, causing the absorption of glucose in the small intestine into the bloodstream [3]. The body then absorbs the sugar in the bloodstream for energy. If diabetic patients have dietary habits that are not suitable for the disease, such as consuming more than the amount of energy they should receive per day or high-energy foods; it will cause the body to secrete insulin not enough for sugar from food, resulting in hyperglycemia. If diabetic patients have proper dietary habits, this will result in lower blood sugar levels [9].

For Intention to perform the behavior (INT), there was a positive direct influence on dietary behaviors for glycemic control. Consistent with past studies [6, 10], it was found that the intention to practice has a direct positive influence on dieting behavior with serious planning and goal setting. As a result, patients should have strict dietary habits to control blood sugar levels. This is consistent with Ajzen's concept of Planned Behavioral Theory of Behavior, which stated that a person's health behaviors are formed as a result of the intention to commit that behavior and it will vary more or less depending on the intention and planning in practice.

For Perceived Behavior Control (PBC), there was also a direct positive influence on dietary habits for glycemic control and action intentions. Consistent with previous studies [6], it was found that cognitive behavioral control had a positive direct influence on food consumption behavior and has an indirect effect on food consumption behavior. Through the intention to practice [10], it is explained that when diabetic patients have the perception of behavior control, it will result in the patients

following strict dietary habits to control blood sugar levels, which will affect the intention to practice. This is proportional to beliefs about control beliefs and the level of ability to control behaviors when given the behavioral factors (perceive power) [6].

For the last variable, Self-Efficacy (SE) was also directly positively influenced dietary behaviors for glycemic control and action intentions. Consistent with the previous study (3, 7), it was found that the perceived ability to practice and the expectation of good results of practice directly influenced food consumption behavior and has an indirect effect on food consumption behavior. The intention to practice explains that the relationship between self-efficacy and the expectation of the outcome of the practice will influence the decision-making and the importance of practice. When a person has an awareness of his or her abilities with high expectations of good results from that practice, it will lead to satisfaction and can perform that behavior effectively [7].

Summary of perceived behavior control, self-efficacy and intention to perform daily dietary behavior to control blood sugar levels, affecting blood sugar levels in patients with type 2 diabetes.

8. Recommendations

8.1 Recommendations from research

1. Based on the research findings, the causal component of dietary behavior for glycemic control was identified. Therefore, a program corresponding to the causal component for dietary behavior modification affecting glycemic control should be established for the blood of a patient with type 2 diabetes.

8.2 Suggestions for further research

1. Development of a dietary behavior modification model for glycemic control in patients with type 2 diabetes by using the causal elements of behavior as inputs in the model development.

2. Development of health promotion and health education programs by applying a health education strategy consistent with the causal component of dietary behavior for glycemic control in modifying dietary behavior of type 2 diabetic patients.

Acknowledgment

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Developing a traceability system for safe vegetables of smart farmers in Nakhon Pathom Province

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Abstract

The purposes of the research on "Developing a Traceability System for Safe Vegetables of Smart Farmers in Nakhon Pathom Province" were to: 1) develop a traceability system for the safe vegetables of the smart farmers in Nakhon Pathom; 2) evaluate the satisfaction with the performance of the traceability system of the safe vegetables of the smart farmers in Nakhon Pathom; and 3) compare the satisfaction with the performance of the traceability system of the safe vegetables of the smart farmers in Nakhon Pathom, classified by personal factors. A mixed-methods approach, combining qualitative and quantitative research, was used in the study.

The findings revealed that: 1) the farmers growing safe vegetables in Nakhon Pathom wanted to use the safe vegetable traceability system to help them manage data and provide relevant information to consumers via QR codes in order to increase their purchasing confidence. In addition, the results of the development and evaluation of the system's performance by experts showed that the overall efficiency of the system was at the highest level ($\overline{x}$ = 4.75, S.D.= 0.48); the efficiency of the performance by function ($\overline{x}$ = 4.83, S.D.= 0.38) and the efficiency of the ease of use of the system ($\overline{x}$ = 4.70, S.D.= 0.53) were all at the highest levels. 2) The 36 safe vegetable farmers had overall satisfaction with the traceability system at a high level ($\overline{x}$ = 4.10, S.D.= 0.17). In the descending order of satisfaction, the aspects were functionality of the system ($\overline{x}$ = 4.20, SD = 0.27), meeting the needs of system users ($\overline{x}$ = 4.09, SD = 0.34), ease of use (= 4.08, SD = 0.24) and information security in the system ($\overline{x}$ = 4.04, SD = 0.43). In addition, 400 consumers of safe vegetables in Nakhon Pathom expressed high levels of overall satisfaction with the system ($\overline{x}$ = 4.29, SD = 0.31). They showed satisfaction with system efficiency at a high level ($\overline{x}$ = 4.29, SD = 0.36), and were highly satisfied with the system's suitability ($\overline{x}$ = 4.29, SD = 0.44). 3) As for the comparison of satisfaction with the traceability system for safe vegetables of 36 smart farmers classified by personal factors, there was a statistically significant difference in satisfaction at the 0.05 level by sex, residence, and age.

Keywords: Traceability system, QR code, safe vegetables, smart farmers

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1. Introduction

In terms of the variety of food consumed today, vegetables are readily available for human consumption since the cost is low, but they are high in nutrients required by the body. In particular, they contain calcium, iron, and antioxidants, which help in maintaining and improving the health of the heart, blood vessels, and immune system. The wide range of vegetables is more than just food because some vegetables are classified as herbs, they can also be used to treat a variety of diseases [1]. As current consumers trends focus more on the consumption of safe agricultural products, especially vegetables and fruits, the products that are grown in a safe environment in the market are not enough for consumer demands [2]. As a result, it is critical to promote safe vegetable cultivation and add value to vegetables through a traceability system in order to increase consumer confidence in purchasing decisions. It will also benefit farmers producing vegetables and other agricultural products to have higher incomes as well. Regarding the data from the Kasikorn Research Center (2020), it is claimed that the traceability system will play an important role in building credibility over the next ten years and contribute to the expansion of marketing opportunities for Thai organic products in both domestic and international markets. It is expected that between 2020 and 2024, the average will be 6.5 percent and will be 8.7 percent between 2025 and 2029, the average. As a result, the opportunity to expand the export market will focus on tropical fruits and vegetables that are "Super Foods," as well as intermediate to advanced processed and additive-free agricultural products. The next generation of farmers will be the driving force behind the expansion of the export market. At the same time, in the domestic market, the emphasis will be on fresh organic vegetables [3]. This is consistent with the research of Madeena Noitubtim and Kanokwan Sukkajornwong (2013). The study concluded that the food safety system is a system created to provide consumers' confidence in their purchases in terms of contaminants free, residues free, and safety for consumption. The product's manufacturing path can be examined from the cultivation process, processing, storage, and food preservation, as well as the process of transporting and distributing products to consumers [4].

Moreover, in case uncertainties or problems occur with the product, the traceability system allows consumers to check the product's details and provides them the opportunity to quickly recall the correct item. It also lowers the possibility of loss of expenses that may be incurred [5]. In accordance

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with Chalermjirarat [6], she suggested that traceability and product recall, as well as counterfeiting prevention, are topics that are brought up at various conferences. Many countries around the world have included these issues as a practice in their requirements, regulations, and laws. As a result, product manufacturers, owners, or exporters must study and follow the further regulations. The heart of the traceability process must be started by identifying items, places, or things in the supply chain that are associated with a unique name and then collecting physical events data from the manufacturing plant, shipments, distributors, as well as retailers.

Therefore, the development of smart farmers is regarded as an adjustment in the agricultural sector to enhance competitiveness in alignment with the country's future development. The agricultural sector must have more potential and expertise to expand learning opportunities and access to information required for a career, as well as to transmit knowledge and needs by area and time. As a result, it is a significant issue that will force the next generation of Thai farmers to compete on a global scale and effectively move above the poverty line.

As aforementioned, the research team, therefore, recognizes the need to utilize technological knowledge and skills to help smart farmers in Nakhon Pathom develop their work processes through the use of technology in agricultural data storage and presentation of product information to consumers, resulting in the increase of consumer credibility through the use of safe vegetable traceability system for smart farmers in Nakhon Pathom Province.

2. Research Methodology

This study employed mixed methodology research, which included both qualitative and quantitative research methods, to achieve the research objectives. The methodology consisted of: 1) qualitative research for gathering insights through non-participant observation, in-depth interviewing technique, and focus-group, as well as a conversational approach during interviewing to find out if the traceability system was required, and 2) quantitative research was employed for evaluating the performance of the developed system and exploring whether the smart farmers in Nakhon Pathom were satisfied with the safety vegetables traceability system.

2.1 Population and samples

The population used in the research was a group of 917 smart farmers growing safe vegetables in Nakhon Pathom and a group of 137 safe vegetable consumers in Nakhon Pathom. Random sampling was used to select the research samples as follows:

2.1.1 The first sample group consisted of a group of smart farmers and a group of safe vegetable growers. Their required qualifications were: 1) being a smart farmer in the Nakhon Pathom Provincial Agriculture Office's Smart Farmer Project in 2016, residing in seven districts, namely Mueang Nakhon Pathom, Kamphaeng Saen, Don Tum, Nakhon Chai Si, Bang Len, Phutthamonthon, and Sam Phran; 2) being between the ages of 20 and 40, and having knowledge and experience of growing safe vegetables for at least one year; 3) possessing leadership and creativity, as well as the ability to participate in the research project in Nakhon Pathom; and 4) being willing to participate throughout the research project. The number of samples was 36 derived by stratified sampling together with the quota sampling method from seven districts, namely Mueang Nakhon Pathom, Kamphaeng Saen, Don Tum, Nakhon Chai Si, Bang Len, Phutthamonthon, and Sam Phran.

2.1.2 The second sample group consisted of safe vegetable consumers. Purposive sampling was used to select the sample of consumers who purchased safe vegetables in Nakhon Pathom Province for consumption. In addition, convenience selection in conjunction with time period random sampling was used for selecting safe vegetable consumers in Nakhon Pathom who purchased safe vegetables for two months during January and February 2021, using the Cochran formula [7], which is used to estimate the population proportion when the precise population size is unknown, but knowing that there are many. The formulas are as follows:

In case of knowing the proportion of the population, the following formula is applied.

$$n = \frac{p(1-p)Z^2}{e^2} \tag{1}$$

If the proportion of the population is unknown, $p = 0.5$, the following formula is used.

$$n = \frac{Z^2}{4e^2} \tag{2}$$

Where:
n = the desired sample size
p = the proportion of traits interest in the population
e = the allowable sample error level
Z = z-value at confidence level or significance level
−95 percent confidence level or 0.05 level of significance with $Z = 1.96$

According to the calculations at a 95 percent confidence level, the allowable error was 5 percent and the proportion of traits of interest in the population was 0.5 of the desired population sizes. As a result of the sample calculation, the sample group consisted of 384 people. In addition, to substitute the error from the questionnaires, 400 sample questionnaires were distributed to the safe vegetable consumers in Nakhon Pathom to collect preliminary data and check system quality.

2.1.3 The third sample group consisted of three experts in the traceability system. Purposive sampling was used for this sample group selection. The experts must specialize in information technology systems and must have qualifications, including an academic position or at least five years of working experience in information technology.

2.2 Research instruments

2.2.1 For the qualitative method, in-depth interview, focus-group, and non-participant observation were used as data collection tools.

2.2.2 For the quantitative investigation, the questionnaires for satisfaction with the traceability system for safe vegetables, which were developed with a 5-level estimation scale and evaluated by three experts, were used to obtain data. They were as follows:

2.2.2.1 The satisfaction questionnaire with the traceability system for safe vegetables for a group of experts;

2.2.2.2 The satisfaction questionnaire with the traceability system for safe vegetables for a group of smart farmers in Nakhon Pathom Province; and

2.2.2.3 The satisfaction questionnaire with the traceability system for safe vegetables for a group of safe vegetable consumers in Nakhon Pathom province

2.3 Data analysis

Descriptive statistics were employed for data analysis in this study, i.e., distribution, percentage, mean, standard deviation (SD), including independent t-test, and one-way ANOVA. In case there was a difference, data were tested in pairs using Scheffe's method and content analysis.

3. Results

3.1 The development of a safe vegetable traceability system for smart farmers in Nakhon Pathom Province was divided into three main parts as follows:

3.1.1 A study of the problems and demand for a safe vegetable traceability system among smart farmers in Nakhon Pathom Province by interviewing and observing was carried out with a sample of 36 smart farmers. 19 of them were males and 17 were females. 21of farmers were from Mueang District, four from Kamphaeng Saen District, four from Bang Len District, three from Nakhon Chai Si District, two from Don Tum District, and one each from Phutthamonthon and Sam Phran. Most of them, 29 farmers, were between the age of 41 and 60, while four were between the age of 21 and 40 and three were over 60. For education, 18 of the samples had a bachelor's degree, 13 held a vocational/high vocational diploma, three graduated primary education level, and two had a master's degree or higher. The monthly income of the samples ranged from 10,000 to 30,000 baht. It was found that the smart farmers had a need for a safe vegetables traceability system. They suggested that the system must be able to store data that support the smart farmers' work as follows: 1) having information about farmers who grew safe vegetables, e.g., name-surname, garden name, address, area size of safe vegetable cultivation, vegetable variety, contact information, and certification of cultivation standards; 2) having certification information for production standards, including GAP certificate, organic agriculture certificate, other standard certificates, and awards; 3) having information on safe vegetable cultivation sites; 4) having information on soil and fertilizer used in agriculture, pesticide detail, and water source used from cultivation to harvesting; 5) being an easy to use system with accurate and complete information display; and 6) being capable of producing QR codes.

3.1.2 The data obtained from a sample group of 36 people were processed by the research team. The data was analyzed, synthesized, drawn conclusions from, and used to develop a safe vegetable traceability system for smart farmers in Nakhon Pathom Province. The development was done together with the SDLC concept, (System Development Life Cycle), which consisted of seven steps to ensure that the system worked as intended and met the needs of smart farmers. An easy-to-use system was created by developing the system with a computer language named Hypertext Preprocessor (PHP) in conjunction with java script. For the part of QR code generating, it was developed with the library PHP Qrcode and connected the system to the MySQL database, which the developed system could be used on the operating system via a link, http://npruonline.com/qrveg/ and provided support to work on smartphones in the form of apps. The system also supported the work on the Android operating system by developing such applications with the Kodular program and providing services via links like http://1ab.in/bbAS.

3.1.3 The performance of the safe vegetable traceability system for smart farmers in Nakhon Pathom Province was evaluated. The system's performance was evaluated and given recommendation by three experts. The investigation of the safety vegetable traceability system for smart farmers in Nakhon Pathom Province is showed in Table 1.

Furthermore, the experts suggested improvement of the safe vegetable traceability system for smart farmers in Nakhon Pathom province. The following are brief summaries of the items:

1. It was necessary to create a page that displays system statistics in the form of graphs.

2. A page showing the location on the map should be created with pictures of vegetables being grown.

3. Additional images, such as logos, related images, etc., should be included in QR Codes.

3.2 The satisfaction with the performance of the safe vegetable traceability system was divided into two groups: that of 36 smart farmers and that of 400 safe vegetable consumers, as follows:

3.2.1 According to the satisfaction survey of users of the safe vegetable traceability system, it was found that the respondents comprised 19 males (52.78 percent) and 17 females (47.22 percent). 21 people live in Mueang District (58.33 percent), while four each come from Kamphaeng Saen and Bang Len Districts (11.11 percent). 29 of them were between the age of 41 and 60 (80.56 percent), and four were between the age of 21 and 40 (11.11 percent). Moreover, 18 of them had a bachelor's degree (50.00 percent), followed by a vocational/high vocational diploma (13 people, 36.11 percent). 26 of them had a monthly income between 10,000 and 20,000 baht (72.22 percent) and 10 people had an income ranging from 20,000 to 30,000 baht (27.78 percent). The majority of respondents, 25 people, had a primary occupation as farmers (69.45 percent), followed by seven people (19.44 percent) who had a primary occupation as private business owners. Overall and in specific aspects, their satisfaction with the system was high ($\overline{x}$ = 4.10, S.D. = 0.17). The following aspects are listed in descending order:

According to the function of the system ($\overline{x}$ = 4.20, S.D. = 0.27), the first three aspects were 1) the accuracy of QR code printing, 2) the speed of the system's operation, and 3) reliability. Following that was the response to the needs of system users ($\overline{x}$ = 4.09, S.D. = 0.34), which consisted of the first three areas, namely 1) the ability to manage members, 2) traceability, and 3) information adding to the system. Next, the ease of use of the system ($\overline{x}$ = 4.08, SD = 0.24) was comprised

Table 1. System performance assessment results.

System Performance Assessment Results	$\bar{x}$	S.D.	Interpretation
The efficiency in working according to function	**4.83**	**0.38**	**the highest level**
1. The accuracy in adding vegetable garden information	5.00	0.00	the highest level
2. The accuracy in printing QR code	5.00	0.00	the highest level
3. The system reliability	5.00	0.00	the highest level
The efficiency of system use	**4.70**	**0.53**	**the highest level**
1. The system's ease of use	5.00	0.00	the highest level

of the first three items as follows: 1) the appropriateness of symbols used to convey meaning, 2) the appropriateness of color used in letters and figures, and 3) the same standardization in the design of image screen. The last one is the security of information in the system ($\overline{x}$ = 4.04, S.D. = 0.43) was comprised of effective control over the use of user rights, pre-authentication of system users at various levels, as well as the assignment of user codes and password authentication for system users.

3.2.2 According to the satisfaction survey on the safe vegetable traceability system of safe vegetable consumers in Nakhon Pathom Province, it was revealed that the majority of respondents were 233 females (58.25 percent) and 167 males (41.75 percent), with 395 people having the status of consumer (98.75 percent) and 5 of them having other status (1.25 percent). The majority were between the age of 21 and 40 (339 people, 84.75 percent), followed by those between the age of 41 and 60 (55 people, 13.75 percent), those aged 60 and over (5 people, 1.25 percent), and those under the age of 20 (1 person, 0.25 percent). The majority of respondents (180 people, 45.00 percent) held a bachelor's degree, followed by 171 people (42.75 percent) holding a vocational /high vocational diploma, 36 people (9.00 percent) graduating secondary education, eight (2.00 percent) graduating primary education, and five of them (1.25 percent) holding a master's degree. The majority of the sample (285 people, 71.25 percent) earned $10,000 - 20,000$ baht per month, followed by 55 people (13.75 percent) having $5,000-10,000$ baht and $20,001-30,000$ baht monthly income, and 5 people (1.25 percent) earning more than 30,000 baht per month. Furthermore, the majority of respondents (176 people, 44.00 percent) worked for private companies, followed by private business owners (113 people, 28.25 percent), government officials/state enterprises (56 people, 14.00 percent), employees (28 people, 7.00 percent), housewives (20 people, 5.00 percent), students/undergraduate students (5 people, 1.25 percent), and doing other jobs (2 people, 0.50 percent). These consumers had a high level of overall satisfaction in all aspects ($\overline{x}$ = 4.29, SD = 0.31). Specifically, the satisfaction with system performance was at a high level($\overline{x}$ = 4.29, SD = 0.36), comprising the top three: 1) appropriate placement of components on the monitor, 2) up-to-date information, and 3) the speed of the application system. Following that, there was a high level of satisfaction in suitability ($\overline{x}$ = 4.29, SD = 0.44), with the top three aspects: 1) the appropriateness of images used to convey meanings; 2) the appropriateness of colors used in the images. 3) the same standardization in the visual screen design.

3.3 Regarding the comparison of smart farmers' satisfaction with the performance of the safe vegetable traceability system, the satisfaction with the performance of the safe vegetable traceability system among 36 modern farmers classified by personal factors was examined. The results were analyzed by inferential statistics, i.e., independent t-test, one-way ANOVA, and Scheffe's method, in order to find out if there was a difference. Gender, place of residence, and age were all considered personal factors. The satisfaction classified by these factors was divided into the following aspects: 1) meeting the needs of system users, 2) working in accordance with the system's function, 3) system's ease of use, and 4) security of information in the system. The analysis revealed that the smart farmers' satisfaction was significantly different at the 0.05 level. The results are presented in Table 2.

However, there was no difference in satisfaction as classified by personal factors of education level, monthly income, and primary occupation.

4. Discussion and Conclusion

The findings of a study on developing a traceability system for safe vegetables for smart farmers in Nakhon Pathom Province were discussed in accordance with the research objectives as follows:

4.1 In developing a safe vegetable traceability system for smart farmers in Nakhon Pathom Province, it was revealed that the system had been developed to meet the requirements of farmers. The system could store and manage data, including deleting, adding, and editing farmers' information. In addition, the QR codes could be printed and the system was easy to use, quickly operated, and reliable. The system's use was also restricted based on the permission level that had been set. This was consistent with Tantidontanet and SBoonying's [2] who conducted research on a prototype for the traceability of safe food crops in the community using RFID technology. The study's findings revealed that the developed system consisted of three main sections: one for administrators who could add, delete, and edit; one for farmers who could save, delete, and edit; and one for customers or consumers, who could come in and inspect the community's safe food growing process before deciding to purchase a product. Moreover, the developed safe vegetable traceability system for the smart farmer group in Nakhon Pathom Province was also concerned with the safety of data storage, with no risk of loss or copying for unauthorized use. Furthermore, the information displayed by the system was accurate, complete, and fast, and the system could clearly display pictures as well as accompanying characters following

Table 2. The results of the comparison of smart farmers' satisfaction with the performance of the safe vegetable traceability system.

The performance of the safe vegetable traceability system	Gender	Sig. Place of residence	Age
1.Meeting the needs of the system users	0.24	0.02*	0.90
2. Working in accordance with the system's function	0.34	0.47	0.54
3. Systems ease of use	0.08	0.11	0.62
4. Security of information in the system	0.02*	0.01*	0.03*
Overall average	**0.15**	**0.32**	**0.45**

the standard to increase consumers' trust in purchasing safe vegetables of the smart farmers in Nakhon Pathom. When the system's efficiency was evaluated, it was discovered that the system's overall efficiency was at the highest level, with the highest level of performance according to function and ease of use. This could be supported with Jaidee and Seresangtakul's [8] research on mushroom cube trace and traceability system. This study described the process of developing a system for monitoring and tracing mushroom cubes. When put into practice, the developed model of this study could help Thai agricultural businesses meet international standards. It was also a system that allowed consumers to obtain the information they needed before making a purchase decision on agricultural products. The results were also consistent with Tantidontanet and Boonying's [2] research, which proposed that a prototype for community-safe food crop traceability using RFID technology could be used to meet the needs of users and consumers who wanted to effectively trace the safety of locally grown vegetables.

4.2 The satisfaction assessment of the safe vegetable traceability system of smart farmers in Nakhon Pathom province showed that, in descending order, the farmers were highly satisfied with the system in all aspects ($\overline{x}$ = 4.10, S.D. = 0.17). The highest aspect was performance in accordance with the system's function, which included the first top three items: 1) the accuracy of QR code printing, 2) the system's speed of operation, and 3) its reliability. Following that, the aspects of meeting the needs of system users were consisted of the first three areas: 1) capabilities for managing members, 2) traceability, and 3) adding information to the system. Next, the system's ease of use comprised the first three items, namely 1) the appropriateness of symbols used to convey meaning, 2) the appropriateness of colors used in letters and images, and 3) the same standardization in terms of screen design. The last aspect was the security of information in the system comprised the ability to use it correctly in accordance with user rights, preauthentication of system users at various levels, and user ID assignment and password to verify the system user. This corresponded to the Digital Government Development Agency's (DGA)[9], which stated that proposal regarding application standards must prioritize the security of personal information (privacy) as well as the security feature (security functional requirement), sensitive information, which must always be encrypted. The results were also consistent with Wuthipanchai[10] research on mobile application platform prototypes for digital agriculture that provided the option of creating a mobile application for farmers and durian buyers as a source of information and to expand trading channels. In addition, the study's findings could be used as a guideline for developing a mobile application platform as a source of knowledge in the field of agriculture, as well as supporting durian trading to help reduce problems in Thailand's agricultural sector. This was linked to the consumer satisfaction assessment of safe vegetables who had evaluated the traceability system of the current study in the form of an application. It was found, according to the evaluation results, that the consumers who used the service had a high level of overall satisfaction in all aspects ($\overline{x}$ = 4.29, S.D. = 0.31). The consumers were pleased with the system's high performance, which included the top three aspects of: 1) the appropriateness of component placement on the monitor, 2) the accuracy of the information, and 3) the application system's speed. Following that, there was a high level of satisfaction in terms of suitability, comprising the first top three, namely: 1) the appropriateness of images used to convey the meaning; 2) the appropriateness of color used in the images to convey the meaning; and 3) the same screen design standard. The results of the present study also aligned with the research of Kettapunt *et al*. [11] on the development of the ORGANIC LEDGER application for participatory organic agriculture (PGS) certification which proposed that the ORGANIC LEDGER application received a rating of 4.88 out of 5 from farmers. As a result, it was clear that the paperless farm practice recording application was effective. It could be used in place of notetaking on paper. The application was a tool for organic agriculture participatory certification that made organic products and the certification system reliable, transparent, accurate, convenient, and appropriate for small farmers.

4.3 As for the comparison of smart farmers' satisfaction with the safe vegetable traceability system, personal factors included sex, place of residence, and age were considered in the following aspects: 1) meeting the needs of the system users, 2) performance according to the system function, 3) the ease of use of the system, and 4) the security of information in the system. The results of the analysis revealed that smart farmers had different levels of satisfaction at the 0.05 level of statistical significance. On the other hand, when considering personal factors of education level, monthly income, and primary occupation, the analysis showed that there was no significant difference in satisfaction at the 0.05 level. The results could be related to the concept of seven steps of System Development Life Cycle (SDLC) proposed by Udomthanatira [12] that the system development process consisted of: 1) identifying problems and needs, studying the suitability, 2) analyzing the needs to develop and design a system for solving the problems, 3) developing and testing the functionality of the system, installing and running the system, and continuous

improving and developing. Therefore, according to the results of the study, it can be said that individual factors affected the development of the system. To develop a system to meet these needs, the concept of the system development cycle should be applied to study and develop various systems.

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Roles of the Calendrical Rites and Traditions of Mon's life at Wangka Village, Sangkhlaburi District, Kanchanaburi Province

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Abstract

This article aimed to study the roles of the calendrical rites and traditions of Mon's life at Wangka Village, Sangkhlaburi District, Kanchanaburi Province. The data were collected by field studies and observation interview recording during 2019 – 2021. The results of the study revealed that Mon people at Wangka Village have migrated to Thailand for more than 70 years. There are traditions throughout the year that reflect Mon ethnic identities as Buddhists and strong worshipers of spirits. Such rituals have shaped the patterns of life and are mechanisms for inheriting Mon culture from the past to the present. Moreover, Mon rituals perform several roles in the establishment of identity, collective memory, and ethnic consciousness; in social order training, socialization, and maintenance of social behavioral patterns; and in the creation of enjoyment and individual mental stability of Mon diaspora. These roles reflect the importance of traditions in relation to ethnic consciousness and adaptation when settling in Thailand.

Keywords: Wangka Village, functionalism, Mon ritual, identity and collective memory

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1. Introduction

Wangka Mon Community is a newly established community in Sangkhlaburi District, Kanchanaburi Province, approximately 70 years old. Mon people in this community migrated from villages and towns in Mon State to Thailand due to the unrest in Myanmar around the year 1947. There have been several waves of immigration until now. Mon people in Wangka Village, therefore, have the status of Burmese diasporas or illegal immigrants who the Thai government has limited residential areas and formulated measures to prevent any movement that may affect the relationship between Thailand and Myanmar [1].

Mon people migrated to live in Sangkhlaburi District because its border is adjacent to Mon State and Thailand has a relaxed policy on the displaced person and better economic conditions. Moreover, the reason includes the generosity of Thai people. Luangphor Uttama–a Mon monk from Mawlamyine in Myanmar, born in 1910 and died in 2006, and the abbot of Wat Wang Wiwekaram from 1961 – 2006 –was the one who led the migration and established a Mon village. He was a worldly and religious leader who influenced the way of life and maintained the mental stability of Mon people at Wangka Village. Luangphor Uttama was the one who planned the coexistence of Mon people at Wangka Village and initiated the restoration of Mon traditions, rituals, and cultures. Therefore, Luangphor Uttama played a role in the birth, existence, and transformation of Mon people at Wangka Village.

Mon people in Sangkhlaburi District have a different status from Mon people who settled in Bangkok and various provinces. This Mon group entered Thailand in the Ayutthaya period and the early Rattanakosin period. They hold complete Thai citizenship and have a way of life, culture, beliefs, and traditions like other Thai people. As for the Mon people who migrated to Sangkhlaburi District, they have the status of Burmese diaspora, having culture, traditions, and spoken language like the Mon people in Myanmar. Furthermore, Mon people in Wangka Village try to maintain and pass on their ethnic and cultural identity, and they associates with their motherland through their customs, rituals, language, and lifestyles.

There are research studies by Deepadung and Damsa-ard [1], Thabsakul [2], Wongpolganan [3], Tabwiset [4] and Kroenkrathok [5] collecting information about calendrical rites and living traditions in the community background. It can be noted that different names and descriptions of traditions were recorded, may be because of different period's data collection. However, from the researchers' data collection in 2018-2020, the conclusion is different from the previous researches. It was found traditions that are related to the way of life and religion of the community. Some are just a telling, some are adapted to the economic and social conditions. This raises the question of what roles these two types of ritual traditions play in the present Mon community at Wangka Village, more than 15-year after the death of Luangphor Uttama.

2. Research Method

This study collected data about calendrical rites and traditions of Mon's life at Wangka Village, Sangkhlaburi District, Kanchanaburi Province. Data collection used informant interviews and participant observations. Interviews with informants

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used informal interview methods. During the interview, audio was recorded and field notes were taken. Data analysis by using related folklore concepts and theories such as Functionalism.

3. Mon Traditions

3.1 Calendrical rites

These traditions are performed at a community level in each month. The months of Mon people at Wangka Village correspond to the Thai lunar month. The details of traditions throughout the year are as follows:

In the third lunar month, there is 'Yahu rice' making tradition to offer to monks on Magha Puja Day, one of the Buddhist important days. Mon people believe that offering Yahu rice give the same merit as offering Yahu rice in the Buddha's era. Before approaching Magha Puja Day, villagers bring glutinous rice, toasted coconut, nut, and sesame to make Yahu rice at the village hall. On Magha Puja Day, they give Yahu rice to monks who come to pray in the village and at Wat Wang Wiwekaram.

In the fourth lunar month, there is Chedi worshiping tradition to pay respect and remember the grace of the Lord Buddha. The ritual happens at Phutthakhaya Chedi for 9 nights before Luangphor Uttama's birthday anniversary. After that, there is another 5-day merit-making activity for Luangphor. The fourth month is considered the month of merit-making by merging two important rituals into a great annual event of the Mon community at Wangka Village.

In the fifth lunar month, there is the Songkran tradition. Before Songkran, 'Khao Chae' is made for offering to monks and giving to senior relatives. During the Songkran festival, elderly people go to the temple for 3-day precept observance. Children have to deliver food and bring water to bathe their parents at the temple. Songkran activities also include building sand pagodas, worshiping ancestor spirits, bringing wood to support the Bodhi tree, and bathing the Buddha image through a bamboo trough. Moreover, male villagers create a human bridge by laying down side by side for monks to walk on. On the last day of the Songkran festival, people gather to put tiered umbrellas on sand pagodas, offer robes to monks, and then pour water of dedication. Songkran is an outstanding tradition of tourists' interest, so it is included in a tourism campaign of Kanchanaburi Province. After the Songkran festival, Mon people hold a ceremony to show respect and thankfulness to 'Phor Pu' for protecting the village and people in the community, including asking for forgiveness for wrongdoing and praying for peace and happiness. 'Phor Pu', in Mon language called 'Panok', is the ghost of the Mon village at Wangka Village. Phor Pu Shrine is located behind Phutthakhaya Chedi. Food offerings to Phor Pu are vegetarian dishes, such as steamed sticky rice, sweets, and drinking water. The village shaman is a person who communicates between Phor Pu spirit and the villagers. In the afternoon of veneration of Phor Pu shrine tradition, there is the 'Klang Ban' merit-making tradition. This tradition is a combination of Buddhism and spirit worship. The purposes are to ward off evil and bad luck, drive away evil spirits from the village, and build morale for people in the community. Community leaders bring small stones to the Buddhist praying ceremony. After that, the monks chant while walking around the village and throwing stones on the roofs of the houses.

In the sixth lunar month, there is Bodhi Tree watering ritual and Nirvana Market. On Vesak Puja Day, Mon people pour water to pay homage to the Sri Maha Bodhi tree that Luangphor Uttama brought from Sri Lanka. This ritual comes from the belief that worshiping the Sri Maha Bodhi tree is like worshiping the Lord Buddha. On the same night, meals are distributed. The buyers bring merit to buy instead of money, while the sellers or givers receive merit in return. This is trading with merit in the area of merit, therefore, is called Nirvana Market.

In the seventh lunar month, there is a ritual to ask for forgiveness from the preceptors. On the day, monks pay homage to Luangphor Uttama and make apologies to preceptor teachers. For the laymen, there are ceremonies to worship teachers of each profession.

In the eighth lunar month, there is the merit-making tradition before the Buddhist Lent. Before the start of Buddhist Lent, young people go to ask for forgiveness from their senior relatives. On the morning of the 15th day of the waxing moon of the eighth lunar month (Asalha Puja Day), people go to make merit, offer food to monks, and offer candles at the temple. In the afternoon, flower offerings are made to the monks who come for praying. On the evening of the first waning day of the eighth lunar month (Lent Day), villagers will provide flower vases as offerings to monks.

In the ninth lunar month, there is 'Nithi Pot' merit-making tradition. Nithi pot is a pot containing things and utensils that want to offer to monks, such as rice, dried food, plates, bowls, spoons, and coconuts. Mon people offer Nithi Pots in the belief that they bury treasures to be eaten and collected in the next life.

In the tenth lunar month, there is the boat floating tradition to dispel bad luck. This tradition is related to the legend of boat floating tradition during the reign of Phrachao Thammachedi. Nine kinds of food are put in the boat as offerings. There are also activities of burning incense and candles to remove bad luck, lighting a lamp as an offering to the Buddha, praying for good luck, making merit and giving alms to monks, and floral offering ceremony. The boat floating tradition is a big ritual event that allows villagers or tourists to join and it is included in a publicity campaign for tourism in Kanchanaburi Province.

In the eleventh lunar month, there is 'The-wo' food offering tradition at the end of Buddhist Lent. Luangphor Uttama has assigned Wat Wang Wiwekaram, Wat Sri Suwan, and Wat Somdetto to take turns hosting this tradition. In this event, people will offer alms to monks and make merit in remembering the day when the Lord Buddha returned to earth from heaven. On the day, there is a traditional football competition to win Luangphor Uttama Trophy. Another important event in October is the merit-making ceremony on the anniversary of Luangphor Uttama's death, which began in 2007. This event reflects the profound reverence of Luangphor Uttama as a worldly, religious, and spiritual leader.

In the twelfth lunar month, there is Kathin ceremony and blanketing Phutthakhaya Chedi tradition. On the night before the Kathin ceremony, Mon people come together to sew blankets for the Chedi and clothing for monks. It has a belief that the Kathin ceremony is a great merit-making to preserve

the religion with a charitable mind which brings happiness and prosperity. In this month, there is also Loy Krathong tradition to worship Phra Upakut in Mon style. People jointly make a large Krathong to put offerings to Phra Upakut, and then float the Krathong into the river in the early morning of the 15th waxing moon of the twelfth lunar month.

According to the field data collection, in the first and second lunar months, around December to January, Mon people do not organize any events.

3.2 Traditions of Mon's life

Traditions of Mon's life at Wangka Village are family traditions related to the four factors for living. These traditions reflect Mon ethnic identity of worshiping ancestor spirits. From the field data collection during 2019 – 2021, it was found that Mon people at Wangka Village strongly worship ghosts along with Buddhism. Ghost worship there includes ancestor spirits, village spirits (Pho Pu), and other beliefs about ghosts. Traditions of Mon's life, both at family and community levels, have still inherited ancestral beliefs and practices. The details are as follows:

Children's 'Kwan' Blessing Tradition

It is a tradition that reflects the belief in 'Kwan' to bless newborns to be healthy, safe, and easy to raise. The ceremony was performed by a master of ceremony, called 'Mo Tham Kwan'. The ceremonial objects are arranged on trays according to the child's gender, with 9 trays for boys and 7 trays for girls. They are bananas, sticky rice mixed with coconut, children's clothing, notebooks, pencils, loose powder, and a stick tied with the necklace and golden ring at the end of the rope.

Ordination Tradition

This tradition reflects the belief and faith in Buddhism of Mon. Parents preferably get their sons aged 7 – 14 to enter the tonsure and to ordain when they are 20. The ordination is normally organized on the birthday anniversary of Luangphor Uttama as homage paying. In this tradition, there is a 'Kwan' blessing ceremony for the ordained person, just like for a newborn child. Parents prepare eight necessities of a monk and an auspicious pot filled with turmeric and soap pod juice for hair clipping. The ordination ritual is performed in a Buddhist monastery, where women are not allowed to enter.

Wedding Tradition

The wedding tradition of the Mon people in Wangka Village today is similar to that of Thai people. They, however, still adhere to the belief that marriage in the same spirit family is prohibited. Marriage women must perform a ghost return ritual to pay respect to the ghost of their male counterparts. Widows are forbidden from holding wedding ceremonies in the morning but can be arranged in the afternoon.

House Celebrating Tradition

Mon people organize house blessing ceremonies for the prosperity of their homes, as well as for peace, happiness, and prosperity of family members. They invite monks to perform the ceremony at the house. They cook and offer food for monks, relatives, and guests attending the event. There are symbolic objects in the ritual that reflect Mon culture, i.e., auspicious pots, Mon food, and Mon language.

Ancestor Spirit Worship Tradition

Mon people inherit the spirits of their ancestors through their sons. It is a must to hold a ceremony to venerate their ancestor ghosts annually. Offerings shall be corresponding to the spiritual family or favorite food of the dead ancestors or give a parting. Some families offer meat dishes, some offer vegetarian food. Mostly, food offerings are bananas, coconuts, sticky rice, steamed rice, sweets, and drinking water. The master of ceremony is the village shaman.

Funeral Tradition

Death rituals of Mon people at Wangka Village vary according to the cause of death. Practices strictly follow the beliefs and customs of Mon. In case of accidental deaths, murders, suicides, or death of children under 12 years of age, bodies must be buried only and no monks are invited for chanting. The ceremony is performed at Sala Daeng. After that, the body is carried on a carriage to the crematorium behind the Phutthakhaya Chedi for funeral services. When there are several deaths happen at the same time, the body of the latest deceased is cremated, followed by the first deceased. This is in the belief that there will be no more fire, which means another death in the village. Mon people perform a funeral ceremony for monks differently from laypeople. It is because monks are considered pure precept observers without passion and they are successors and propagators of Buddhism. Therefore when a monk passes away, Mon people hold a grand funeral to show their utmost gratitude and respect. This tradition obviously reflects Mon ethnic identity as strong Buddhism respecters and spiritual worshipers through symbolic objects, i.e., a moveable crematorium, a deceased carriage, a brick carriage, and rituals, i.e., body swaying and snatching traditions.

According to the field data collection, it was found that the ritual traditions of Mon people at Wangka Village reflect Mon ethnic identity with respect to Buddhism and strongly worship ancestor spirits. Such rituals have been mechanisms for inheriting Mon culture from the past to the present. It also connects Mon people to their homeland and assimilates Mon diaspora into the local community in Sangkhlaburi District.

Lifestyles changed after the construction of the Vajiralongkorn Dam, living life under the policy of Thailand, ethnic diversity, contexts and phenomena occurring in today's society– particularly the tourism context in Sangkhlaburi District that has affected the way of life, consciousness, and thinking of Mon people at Wangka Village–are factors that have influenced traditions, rituals, patterns of life to adapt to changes. These factors play an important role in expressing and inheriting Mon ethnic identity and culture, as the researchers will discuss in the next section.

4. Roles of Mon's Ritual Traditions

It can be claimed that Mon traditions at Wangka Village are linked to Mon culture in Myanmar. Luangphor Uttama revived the traditions, set guidelines, and inherited the identity of Mon through various traditions and rituals.

Bascom [6, 7], author of the article "Four Functions of Folklore," explained that different types of folklore may play different roles and some types of folklore may play a number of roles. Bascom has categorized the roles and duties of folk-

lore in four ways: 1) explaining the origins and rationale for ceremonies, 2) serving as an education in a society that uses narrative traditions, 3) maintaining social normative behavioral standards, and 4) providing enjoyment and a solution to personal frustration [6].

Regarding the study of ritual traditions of Mon community at Wangka Village, Sangkhlaburi District, Kanchanaburi Province, the researchers have classified the roles of the traditions as follows:

4.1 Role in identity establishment, collective memory, and ethnic consciousness of Mon Diaspora

4.1.1 Identity establishment

Traditions and rituals of Mon diasporas at Wangka Village play an important role at both the individual and community levels. The rituals bring together the power of people in the community and create a sense of belonging or group. Performing traditions and rituals outside the homeland together with explaining ritual origins and reasons for performing, telling myths, stories, and beliefs, talking about the history and background of Mon ancestors create an identity and collective memory and maintain the ethnic consciousness of Mon diasporas in Thailand.

Since myths, stories, and beliefs are important components in explaining the origin of the rituals; they play an important role in establishing the identity of Mon ethnic group. The exemplifications below show how these traditions help maintain Mon identity.

The legend of Hongsawadee City and two golden swans swimming at the beach told the story of the great Mon Kingdom establishment. Mon Kingdom was civilized and prosperous. Despite losing in the war, the prosperous culture had influenced and was the cultural origin of many countries. The legend of Hongsawadee City and the golden swan; therefore, plays a role in explaining the importance of the swan as a symbolic animal. Swans appear as a symbolic object in various rituals, which clearly represent the identity of Mon ethnic group.

The legend of boat floating to remove bad luck during the reign of Phrachao Thammachedi originated the boat floating tradition of Mon people at Wangka Village. It is held to worship deities of water, forest, and land. This tradition reflects the faith in Buddhism and beliefs in misfortunes and bad vices that affect living life. There are ceremonies to ward off bad luck, extend life, and pray for expelling bad things and blessing peaceful life. Therefore, the boat floating tradition shows the Mon identity and considers the evidence of Mon identity building as Buddhists and spirit worshipers.

4.1.2 Collective memory and ethnic consciousness of Mon Diaspora

The story of Luangphor Uttama and the construction of Phutthakhaya Chedi, as well as bringing the Buddha's relics and Sri Maha Bodhi Tree from Sri Lanka to enshrine at the Chedi, explains the origins and the relationship between the Phutthakhaya Chedi worshiping tradition in the third lunar month and the tradition of watering the Bodhi Tree and Nirvana Market in the sixth lunar month. These two traditions had never been done at Wangka Village before the construction of the Chedi, and Luangphor Uttama revived them after building Phutthakhaya Chedi. This tradition helped create collective memories of this Mon diasporas group who performed the same rituals when they lived in the Mon State, Myanmar.

Mon traditions at Wangka Village play a role in creating collective memories of when they grew up and lived in the Mon State, collective memories of Luangphor Uttama as a center of mind, and collective memories of the former Wangka Village as a center of Mon diasporas in Sangkhlaburi District. Stories and past memories are important to the way of life and society construction of Mon people at present Wangka Village. This Mon group has thus formed collective memories of the individual and the community through various traditions and rituals to understand the existence in the present life and create a sense of belonging to maintain ethnic consciousness among the displaced Mon.

It can be concluded that the Mon traditions at Wangka Village play a role in building the identity and collective memories of Mon diasporas. This is consistent with what Na Thalang [8] said that cultural traditions in society have a function in responding to human needs in terms of fundamental factors, social security, and mental stability. Traditions, therefore, meet the needs of human beings both socially and mentally. Furthermore, they are a matter of gathering people's powers in society. Performing rituals together makes the members of society warm and secure, and create the sense of belonging. Rituals are, therefore, an important mechanism for creating ethnic identity.

4.2 Role in social order training, socialization, and maintenance of social behavioral patterns

Na Thalang [8] explained that in the past society relied on telling traditions related to social order training in order for members who grew up in that society to learn about the rules of society, values that society sees as good, an attitude that society sees as a bad thing, as well as behavioral and ethical norms of society. Therefore, folklore plays a role in cultivating social order, cultivating values, and maintaining behavioral norms for society.

The life of the Mon people at Wangka Village under the ruling of Thai government as displaced persons is adhere to Luangphor Uttama's three rules of living which are refraining from alcohol drinking, refraining from gambling, and refraining from stealing and sexual misconduct. Additionally, the ritual traditions that Luangphor Uttama revived and Mon people have followed until today are an important mechanism for training social orders, socializing, and maintaining standard behavioral patterns of society. As a result, the coexistence of Wangka Village community is peaceful and does not cause problems for the Thai government.

Mon people are trained in social orders through thorough traditions and rituals. They create rules and behavioral norms that everyone should mutually accept and follow. There are also criteria and agreements determined to be aware of. Consequently, Mon people learn the rules of coexistence, aware of their roles that should and should not be done, and duties as community members by participating in community activities. They also learn to work as a team, have community unity, and help each other. Mon children and youths are educated about community history and background, way of life, and

local wisdom. Moreover, they are instilled in values, attitudes, beliefs, and customs with parents and senior relatives as role models in daily life. Allowing children to participate in or attend various traditions and rituals, they can absorb Mon culture unconsciously. Knowledge and experience that the young generation acquires through various traditions and rituals significantly encourage self-learning through cultural identity and learning rules and norms of society.

Mon traditions at Wangka Village reflect their belief in Buddhism along with strong beliefs in ghosts. Belief in Buddhism is a spiritual anchor that helps controlling behavior and maintaining behavioral standards and disciplines of coexistence. However, beliefs in ghosts help keep people in line with social customs and patterns. Practices to ghosts are a mental anchor for people in the community to fear wrongdoing and adhere to traditions and rituals.

The role in socialization is manifested through ritual traditions, for example, in the merit-making tradition on the birthday anniversary of Luangphor Uttama. It is an annual event of Wat Wang Wiwekaram with multi-day activities. Mon inhabitants in each village will share their duties to preparing venue, activities, performances, and food for offerings to monks and welcoming visitors. The Yahu rice tradition in the third lunar month, another exemplification, reflects the values of giving and sharing. It emphasizes the behavioral norms of coexistence with generosity and mutual assistance. When it comes to Songkran tradition, Mon people must return home to show their gratitude to their parents and visit their ancestors, no matter how far they work or live. This ritual reflects the values of gratitude. It is also a good strategy to encourage Mon people to return home by establishing a norm that at least once a year on Songkran Day, they must gather and make merit together and share each other's suffering. This can instill love and harmony in the family and community.

To sum up, the Mon traditions at Wangka Village play an important role in controlling and creating social orders, rules, and norms for displaced Mon. The traditional practice is a process of socialization that causes Mon people at Wangka Village to strongly adhere to social rules and customs of their ancestors.

4.3 Role in creating enjoyment and building mental stability of individuals

The ritual traditions of Mon people at Wangka Village play a psychological role in creating enjoyment. Organizing traditions in the community is an opportunity to have fun from various entertainment activities, helping villagers to relax from tiredness and stress at work. As in the third lunar month, there is a grand annual event of Wat Wang Wiwekaram, Chedi worshiping tradition and merit-making merit on Luangphor Uttama's birthday anniversary. At this event, there are various entertainment activities, including theatrical performances, ancient boxing, folk music, and Li-Ke Mon. Li-Ke Mon is a rarely seen performance because it has to be hired from Myanmar. Both male and female actors dress in colorful clothes in Mon style. There are various forms of performances with musical instruments, including singing, dancing, comedy, and musical play. All of them create a lot of happiness and fun for Mon people at Wangka Village.

Living in Myanmar, the status of the Mon people was a minority group with no own land. When migrating to Thailand, they have to live under the rules of Thai society as displaced persons. This status made Mon people at Wangka Village feel unstable, both physically and mentally. Moreover, with no Thai citizenship, they are unable to access their desirable rights and employment opportunities. Mon people feel insecure about the risk of being pushed out of the country and unconfident about their illegal living status. Additionally, being displaced persons who migrated from the homeland to face adversity has badly affected morale in life. Mon traditions are able to be a part of building morale and motivation for family members and the community. Moreover, they help build mental stability and inspiration in life. When there is a ritual, those who go to work outside the area return home to join the ceremony and share their life. In other words, family members reunite and have a chance to encourage and express goodwill to each other. Mon traditions, therefore, play a role in creating mental stability and encouragement.

Worship of Phor Pu Shrine tradition derived from the belief in ghosts protecting the village. The Mon people of Wangka Village greatly respect Phor Pu, a spirit who takes care of and protects the village. The story of Phor Pu's sanctity has been passed on from generation to generation. When Mon people hold a wedding ceremony, ordination, house celebrating, as well as go to work or study and travel far away from the village, or do businesses, they usually pay respects to Phor Pu for safety, encouragement, happiness, success, and prosperity. After Songkran tradition, Mon people join to organize an event to pay respect to Phor Pu's shrine every year in order to express their gratitude to Phor Pu for protecting the village and community members. The village shaman is a person who communicates between Phor Pu spirit and the villagers, and forecast the future events or suggest a solution for a bad incident happening in the village to bring about peace to the community.

In conclusion, Mon traditions at Wangka Village play a role in both entertaining and building mental stability. This is consistent with what Na Thalang [8] said that folklores have an important direct function in the mental aspect. It is because folklore can offer a compensatory alternative to what human desires but cannot achieve in real life.

5. Conclusion and Discussion

Regarding the study of the roles and functions of the calendrical rites and traditions of Mon's life at Wangka Village, it illustrates the ethnic identity and roles of traditions for various ethnic and displaced person groups. Mon traditions have their roles and significance to Mon people at both individual and community levels. It serves as a communication tool to understand the displaced Mon as an insider who is aware of and maintains Mon ethnic identity. These traditions also communicate to the outsiders by showing Mon ethnic identity in ethnic diversity areas. At the same time, Mon traditions at Wangka Village are a tool for negotiating power relations with Thailand, as well as other ethnic groups in the area. This is in line with Wasiwiwat and Jaruworn [9], who stated that folklores play an important

function in responding to the psychological needs of people and social security. However, in the age of cultural diversity, each individual group living together in society requires similar or equal levels of rights and priorities. Thus, it appears that folklores are used as a tool to negotiate power relations between groups of people coexisting in society.

In addition, the rituals of Mon people at Wangka Village also play an important role in economy and tourism. Mon ethnic identity and culture presented through various ritual traditions of Wangka Village community represent the original Mon in Myanmar. This study applied an embedded field study, which was different from going as a tourist visiting Mon Bridge and staying in a homestay, and doing tourist activities like almsgiving activities, taking photos with Mon people, and dressing like Mon and applying Tanaka powder. Regarding the embedded field study, Mon culture is cultural capital that this diaspora group uses as an economic opportunity by presenting Mon ethnic identity through Songkran tradition, boat floating tradition to dispel bad luck, the Bodhi tree watering tradition, etc. In the tourism context, these are traditions that strongly present Buddhism identity. The selection of traditions to become tourism activities of Kanchanaburi Province shows that this group of Mon uses their rituals to communicate with the Thai state and to be recognized as a displaced group who creates economic and tourism benefits, not a burden. On the one hand, these traditions are used to maintain Mon ethnic identity in the new settlement. The rituals of Mon diasporas are, therefore, of economic importance along with cultural values and ethnic identities.

The contexts outside the motherland and being under the ruling of the Thai state, including the social context and changes in various aspects, influence the way of life and cultural identity of the Mon ethnic group. Ethnic boundary is proclaimed through cultural mechanisms by expressing Mon ethnic identity through ritual traditions to prove the existence of the Mon ethnicity. The ritual traditions of the Mon at Wangka Village at present have been adapted to suit various contexts, especially tourism. At the same time, efforts have been made to maintain and carry on the traditions, rituals and culture of Mon in accordance with the limitations of area and status of being Mon diasporas.

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The effect of vocabulary development through narrow of second-grade learners

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Abstract

This research aims to investigate the effect of vocabulary development before and after teaching through narrow reading, survey the satisfaction with narrow reading among learners in terms of vocabulary development, and interview teachers with regard to experimental group development and the vocabulary development of learners. The participants in this study consisted of 40 learners in the first semester of the 2021 academic year at Chumchonwatsripachantakham School, Prachin Buri Province, Thailand. They were selected by cluster random sampling. The research instruments in the study were lesson plans based on vocabulary development through narrow reading, vocabulary, reading comprehension tests, satisfaction questionnaires about the study, and interviews with teachers regarding development. The data collection of this study employed online learning. The learners were assigned the pretest before using the treatment. They were taught vocabulary by the narrow reading technique and took the posttest after the treatment to investigate their vocabulary development and reading comprehension. The findings revealed the advantages of vocabulary development through narrow reading and satisfaction with the vocabulary competency of the learners. The open-ended questionnaire on the satisfaction of the learners indicated that learners had knowledge of the vocabulary used in the study. The interview responses of teachers implied that the vocabulary ability of learners had been enhanced. Consequently, narrow reading enabled vocabulary improvement as the satisfaction of learners and teachers interview effectively.

Keywords: Vocabulary development, reading comprehension, narrow reading

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1. Introduction

In the 21st century, language is an essential part to communicate with people around the world for enhancing the capability of communication in daily life as education, livelihood, and creating understanding of cultures and vision of the world community. English is an international language for increasing the diverse cultures and viewpoints in the world community, conducive to friendship and cooperation with various countries. The development of English skills is the most important for improving the capacity of the people who use English language in their daily life. English language is widely used as a second language or foreign language in many countries and become an increasingly influential language to connect with other people in the world. As Asean Economic Community (AEC) was founded in December 2015 by ten members who joined forces to create a single market and industrial base, a highly competitive region with equitable economic development and full integration into the global economy, English language is the main language to communicate with the countries in ASEAN. It evidenced that it is crucial for Thailand to develop English language for Thai citizens with the requirement of English language competency and to provide them the occasions in the future. Therefore, Thailand has realized the importance of English language to enhance the ability to use language skills in their lives. This means Thai learners have to improve the English abilities. The vocabulary knowledge has crucial role for language learners. Richards and Renandya [1] concluded that the fundamental component of language proficiency was vocabulary, which served as the foundation for how well pupils listened, spoke, read, and wrote. The Panel [2] concluded that vocabulary instruction consisted of direct (explicit) and indirect vocabulary instruction (implicit) for increasing vocabulary capacity. Implicit and explicit are the parts of main method of vocabulary teaching and an appropriate approach for solving the problem of learners. Regarding explicit learning as direct learner attention [3], explicit instruction and learning were provided the target involving vocabulary breadth, elaborating vocabulary, and building fluency that extended the learners' perception of high frequency, general academic vocabulary, and crucial technical vocabulary. Reber [4] conducted that implicit learning was a process in which subjects acquire information about a complicated, rule-governed stimuli environment without wanting to and without realizing what they have learned. In the research, he regarded implicit learning as the process of nature perception of learners. The process of learning vocabulary affected the reading skills of English. Rupley [5] concluded that the reader's text processing and interaction with the author were aided by vocabulary knowledge, which promotes the formulation and validation of concepts and learning. Many researchers advised that the implicit process should continue with narrow reading because learners are exposed to numerous authentic texts on the same topic (narrow reading).

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Similarly, Krashen and Brown [6] concluded that the narrow reading strategy was to read texts by a single author or on a particular subject of interest, ensuring understanding and natural repetition of vocabulary and grammar.

As discussed previously, the researcher believed that this technique would help learners acquire the essential knowledge and improve the problem of vocabulary learning and readability effectively by connecting vocabulary competence and reading ability to their daily life skills. The researcher determined to conduct the research for improving the vocabulary competence by applying narrow reading with second grade learners at Chumchon Wat Sri Pachantakham School, Prachinburi Province. As education development plan of Prachinburi Primary Educational Service Office 1, it has a mission to enhance the outcome of education to achieve international standards by developing English language performance of learners to a higher level. Moreover, the schools of Prachinburi Province have the Local Assessment System Test (LAS) for measuring the ability of learners. Chumchon Wat Sri Pachantakham School (C.W.S.), a large primary school with seven hundred twenty-four learners, has the school-based curriculum development and is a sufficiency economy learning center located in Prachantakham District, Prachinburi. Therefore, the researcher selected second-grade learners of Chumchon Wat Sri Pachantakham School as the experimental group for improving vocabulary development and preparing for LAS testing of Prachinburi Primary Educational Service Office 1 mission. The researcher believed that narrow reading could enhance learners to the highest potentiality and be appropriate to learners.

2. Objectives of the Study

2.1 To investigate the effect of vocabulary development before and after teaching through narrow reading technique.

2.2 To examine satisfaction towards vocabulary development of learners.

2.3 To examine teachers' opinions toward the vocabulary development of learners.

3. Literature Review

3.1 Vocabulary acquisition language

Richards and Renandya [1] claimed that vocabulary was the main component of language proficiency and provided the basis for how well students listened, spoke, read, and wrote. Furthermore, the term "vocabulary" refers to the "words we must know in order to communicate successfully."; words in speaking (expressive vocabulary) and words in listening (receptive vocabulary). Krashen [7] mentioned the input theory of language learning. First, learners were interested in the understanding of the word. Second, the words should contain terms which were just outside the learners' accomplishment. Third, the learners could not feel troublesome with the foreign language.

3.2 Explicit vocabulary instruction

In accordance with National Reading [2], explicit vocabulary instruction is efficient for learning vocabulary that students have executed definition or other quality of words to be learned. Ellis [8] stated that explicit instruction referred to attempts to intervene the process of interlanguage development. Explicit instruction or formal instruction improved text understanding and information usage [2]. In the goal of building a large recognition vocabulary, Decarrico [9] described that explicit instruction integrated a new word with old, providing a number of encounters with a word and promoting a deep level of processing.

3.3 Implicit vocabulary instruction

Implicit learning was first investigated by Reber [4]. He explained a process during which subject acquire knowledge about a complex, rule-governed stimulus environment without intending to and without becoming aware of the knowledge they have acquired. In the research, he regarded implicit learning as the process of nature perception of learners.

Hunt and Beglar [3] stated that implicit learning was the one of enlarging and strengthening of vocabulary breadth, and would be complicated and evolved with vocabulary. Decarrico [9] mentioned that implicit vocabulary learning occurs when the mind is focused elsewhere, such as understanding a text or using language for communicative purposes. The point of an implicit was "attract learner attention" and "minimize any interruption to the communication of meaning" [10].

3.4 Narrow reading

The narrow reading strategy was the strategy of reading with one author or about a single topic interest which increased reading comprehend and natural reception of the words and grammar of learners [6].

Stephen [11] stated that narrow reading will be more enjoyable because it is restricted to what the reader really wants to read. It will be more comprehensible, because the reader will already have a great deal of background knowledge and will gain more background knowledge by reading. In addition, he argued that narrow reading had more advantages. First, writers had favorite expressions and distinctive style which topics had their own vocabulary and discourse, narrow reading provides a built-in review. Second, background knowledge was an enormous supporter of comprehension.

3.5 Vocabulary and readability

Koda [12] concluded that successful comprehension was heavily dependent on the knowledge of individual word recognition, and the relationship between vocabulary and reading comprehension that not only first language and also second language learners. Moreover, Hirsch [13] stated that proper reading comprehension required a person to know 90 to 95 percent of the words in a document. Knowing that percentage of terms assisted the reader to have confidence in what was being stated and, as a result, properly estimating what the familiar words mean.

4. Conceptual Framework

In the study, narrow reading was an independent variable. Vocabulary development, reading comprehension, and

Table 1. The comparative relation of mean scores of pretest and posttest.

Group	Time	N	Mean	SD	T-test
Experimental group	pretest	40	14.15	2.160	29.756
	posttest	40	25.18	5.480	

the satisfaction of learners toward vocabulary development and teachers' opinion on experimental development were dependent variables.

5. Research Methodology

The study was an experimental research design that was conducted with ninety-eight second grade learners (four classes) at Chumchon Wat Sri Prachantakham School, Thailand. The sample of the study was forty learners (two classes) selected by cluster random sampling. They were taught vocabulary with five lesson plans through the narrow reading method. The learners were asked to do the pretest and posttest on vocabulary competence and reading comprehension before and after the experiment. Moreover, learners were asked about satisfaction and the teachers were interviewed.

5.1 Research instruments

The instruments of this study consisted of (a) five lesson plans based on vocabulary development through narrow reading, (b) English vocabulary and reading comprehension tests, (c) learners' satisfaction questionnaires, and (d) teachers' interview form. The experiment was conducted through online learning.

5.2 Data collection

The study was an experimental design that applied the one-group pretest-posttest design.

5.3 Instrument development

The Index Objectives Congruence (IOC) was used to evaluate the lesson plans by the three experts for improving the difficulty of language content and activities in the lesson. After that, they were trailed with learners.

5.4 Data analysis

For the study, the data were analyzed as followed:

1. The pretest and posttest scores of the vocabulary development and reading comprehension test were analyzed for mean scores and standard deviations. Moreover, the mean scores of pretest and posttest were analyzed by the dependent t-test to investigate whether there was a statistically significant difference in the vocabulary development in the experimental group before and after the study.

2. The data from the questionnaires about learners' satisfaction with the vocabulary development through narrow reading were analyzed and interpreted according to Likert and Best [14].

3. The interview data were analyzed by using content analysis. The researcher summarized the data from the interviewing and discussed the data descriptively.

6. Data Analysis

6.1 The learners' vocabulary development before and after teaching through narrow reading

The comparison of the learners' vocabulary development scores before and after teaching through narrow reading had been conducted in the study.

The result in the Table 1 showed a significant difference of vocabulary development competence between pretest and posttest of the second-grade learners at .05 level. The mean score of the posttest (M = 25.18, SD = 2.480) was higher than the pretest.

It can be concluded that learners' posttest score signifies the vocabulary development of learners. The pretest and posttest mean scores were different at 10.68 in average. The findings revealed that the learners' vocabulary competency through narrow reading was greatly higher than before the experiment.

6.2 The learners' satisfaction with the vocabulary development

The overall learners' satisfaction with the contents and the benefits of the vocabulary development were highly positive. The learners' satisfaction showed that the procedure of vocabulary development through narrow reading was suitable. Moreover, the examples of open-ended questions in the second part are as followed:

Student 1 "Vocabulary and stories were interesting to me and I could answer reading comprehension questions."

Student 2 "I could find the same vocabularies in each story and answer the meaning of the words."

Student 3 "I enjoyed with the jigsaw activity which I matched the correct picture and vocabulary with my friends."

6.3 The teachers' opinions toward the vocabulary development of learners.

In the study, the researcher interviewed two teachers who taught using narrow reading. The interview can be concluded that teachers' opinion also is consistent with the learners' results. All teachers answered that "learners had gained vocabulary from the lesson," "learners had shared the meaning of vocabulary with their friends," and "learners can answer the researcher's questions clearly."

7. Discussion

7.1 The learners' vocabulary development before and after teaching through narrow reading

The study was examined the effectiveness of narrow reading on vocabulary learning development and reading comprehension of second grade learners. The score of the learners' posttest (M = 25.18) was higher than the score of learners' pretest (M = 14.50). The pretest and posttest score was different at 10.68 in average.

The finding of the study was in line with the results of the study [15] titled the Effect of reading of interest on reading comprehension and incidental vocabulary learning: A case of narrow reading. The focus of the study was reading comprehension and incidental vocabulary learning development of learners. The finding of the study indicated that narrow reading

could enhance reading comprehension and facilitate incidental vocabulary learning.

7.2 The learners' satisfaction with the vocabulary development

The learners' satisfaction showed highly positive (M = 4.8) about the content and the benefit (M = 4.62). According to the learners' satisfaction, they believed that narrow reading helped develop vocabulary and reading comprehension increasingly. In the open-ended question, learners reported the vocabulary and contents they learned in the classroom. The comments in open-ended questions signified that learners were capable of gaining the knowledge in the study.

The result of learners' satisfaction was supported the research of Rai sa-nguan and Sukying [16]. They explored narrow reading and EFL learners' vocabulary learning in a Thai Buddhist university. The proposes of the study were to investigate the effect of narrow reading on vocabulary learning in a Thai university learning context. It also sought to explore the students' overall attitudes toward the narrow reading approach. The finding showed that after the treatment of narrow reading, most participants incrementally developed their knowledge of the target words than the control group. In addition, the questionnaires indicated that learners were interested and satisfied with narrow reading and they got improved after the treatment.

7.3 The teachers' opinions toward the vocabulary development of learners.

The result of teachers' interview revealed that the learners were improved and increased their vocabulary development so that learners had shared reading comprehension to the teachers and their friends. Moreover, the improvement of learners' reading comprehension was evidenced by learners could answer the researcher's questions clearly. In addition, learners were more confident to speak English in the study. The obstacle to the vocabulary development of learners was the individual difference in English competency level. The result is consistent with Kang [17] who explored the effect of narrow reading on L2 comprehension and vocabulary acquisition with sixty-eight EFL learners (between 17 and 18 years old) from two South Korean secondary schools. The participants were separated into the groups of the narrow reading experimental group and the control group. The instruments were pre- and post-tests, reading texts (based on narrow reading), and the interview questions for learners. The finding presented that the experimental group using narrow reading significantly obtained higher posttest scores than the control group.

As the discussion of the study, it can be concluded that narrow reading approach influenced the development of reading and vocabulary performance of learners.

8. The Implications of the Study

As previously stated, vocabulary knowledge was an essential factor in English learning for improving English ability. Therefore, educators in English teaching might be more concerned with vocabulary development of learners according to individual learning, diversities, and learners' ability. Moreover, vocabulary competency can be the connector to other English language skills such as readings. Educators, therefore, should provide learning materials or other approaches for vocabulary development to learners.

9. Recommendations for Future Study

In the study, there were some recommendations for further study that the research might be developed and improved in two aspects. First, the period of the study could be longer than five lessons in eight weeks. The population for data collection might be increased for data effectiveness. The contents of the study might be diversified for learners to choose their story interestingly. Second, it would be interesting to study long-term memory for vocabulary learning of learners for investigating how long learners memorize the word after the experiment. Moreover, it could be possible to find out how many words learners could remember, including spelling, meaning, and pronunciation.

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Mapping the gender gaps in TVET practices: A literature review

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Abstract

Technical and Vocational Education and Training (TVET) is the formal or informal education and training process centered on acquiring practical or technical skills to improve workplace learning and develop an individual's occupational abilities. However, there are non-inclusive practices in gender in the TVET fields. This study coined them as the gender gaps. This study aims to review various literature on the TVET practices to map the gender gaps. In addition, solutions to bridge the gaps were also identified in the literature. Pieces of literature were reviewed and inductive thematic analysis was conducted with MAXQDA resulting in major themes. For gender gaps, the major themes are gender stereotyping: challenges to inclusivity, culture as factors of gender discrimination, and parenting styles influencing career choices. Policy and guidelines towards equal TVET access and practice, internship and career programs as industry pathways, and community support system towards gender inclusivity are the emerging themes to bridge those gaps. The results of this study may provide insights into the understanding of the gender gaps that may be helpful in the development of inclusive policies and guidelines in the TVET system. Further, this study recommends further inquiry into the gender literature of TVET since there is a limited number of readings available in the field. With the changing and updating nature of the industry, further study on the same nature should be pursued to keep TVET institutions gender-sensitive and gender-responsive.

Keywords: gender gaps, TVET practices, literature review

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1. Introduction

Technical and Vocational Education and Training (TVET) is the formal or informal education and training process centered on acquiring practical or technical skills to improve workplace learning and develop an individual's occupational abilities. According to UNESCO [1], TVET entails the acquisition of practical skills, attitudes, comprehension, and information connected to vocations in diverse sectors of economic and social life. As such, TVET has long been acknowledged as a vital part of human resource development (HRD) and a critical tool for socio-economic development [2, 3]. Furthermore, TVET can be a significant driver in achieving the SDGs by 2030, such as reducing poverty, expanding opportunities for lifelong learning, and creating jobs and decent work for all [4 – 6].

However, gender gaps existed in the TVET system. These gaps are in the form of impending problems thriving a long time ago in the history of TVET. These problems may include gender stereotyping [7] as influenced by culture [8], parenting styles [9], or religion [10], among others.

2. Conceptual Framework

Gender equality is necessary for achieving sustainable development, which cannot be accomplished without women's full participation and engagement. Women, at all levels, must have equal access to decision-making, leadership, opportunities for employment, political participation, economic resources, and, most importantly, access to high-quality education [11]. However, in the technical-vocational field, gender stereotyping is rampant. TVET systems are frequently biased against women, affecting men's and women's selection, access to, and participation in specific learning programs or occupations. As a result, this gendered division of labor perpetuates gender inequalities in the workplace and throughout society.

UNESCO [12] recognized this impending problem in the industry. TVET can increase women's productive participation in the labor market by equipping them with the skills necessary to perform future jobs. This potential, however, remains largely untapped in specific occupational sectors. Women are significantly less likely to enroll in TVET in most developing countries.

Sustainable Development Goals (SDG), specifically SDG 4, focus on quality education and call on the Member States to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all." The International Center for Technical and Vocational Education and Training (UNESCO-UNEVOC) establishes a plan to improve national TVET systems through institutional transformation, capacity building, and international cooperation. Their Medium-Term Strategy for 2018-2020 focuses on the three thematic priorities. One of those three is the promotion of equity and gender equality in TVET [13]. According to Alam [14], as cited by Ali Idris and Mohammad [15], technical and vocational knowledge is the primary driver of a nation's economic and social development; as a result, investing in human capital is an

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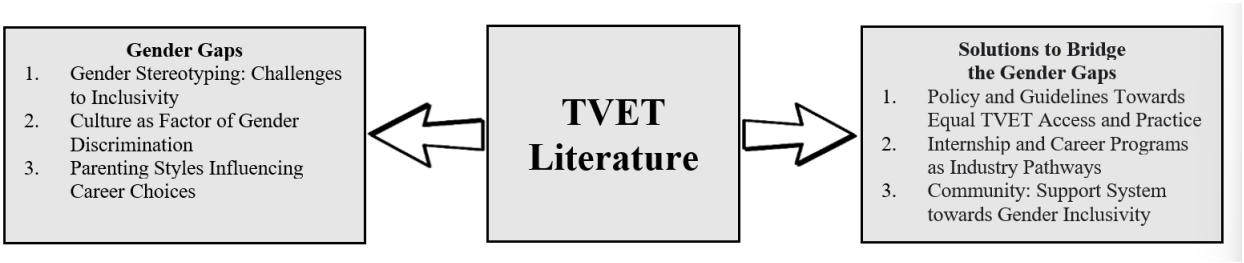

Figure 1: Conceptual framework of the study.

investment in a country's future. However, gender disparities persist globally in women's access to skill development and labor market participation. Women face numerous obstacles, including gender bias in occupational choices, barriers to education and training, particularly in rural and informal economies, and sociocultural and economic constraints. To address these issues, countries must incorporate gender considerations into their national skills development policies and strategies, create gender-sensitive training environments, expand opportunities for women in technology-intensive fields, expand opportunities for men in social and care work, promote role models, and encourage and enable women to participate in lifelong learning opportunities.

Due to the government's emphasis on women's equal access to education as a human right, statistics show that enrollment of girls in primary and secondary school has increased significantly. However, this is not the case in Technical and Vocational Education; very few women enrolled in vocational courses, mainly technical, due to the significant challenge women face in school and even after graduation [16].

The framework used in the conduct of this study is shown in Figure 1. TVET literature is the primary source of data in this study. Twelve articles were scrutinized to identify the gender gaps existing in various literature in TVET. Only twelve were identified because, surprisingly, only a limited number of publications related to gender in TVET. Only seven qualified for review out of the twelve articles. From the analysis of data using an inductive thematic approach, gaps were identified. The gender gaps are gender stereotyping: challenges to inclusivity, culture as factor of gender discrimination, and parenting styles influencing career choices. These gaps affect gender equality in the TVET system, making it non-inclusive. However, the articles also discussed solutions on how the stakeholders of the TVET system bridge the gaps. The main themes that emerged are policy and guidelines towards equal TVET access and practice, internship and career programs as industry pathways, and community: support system towards gender inclusivity.

This study is a literature review. Thus, it is limited to the available and qualified TVET literature that is aligned with gender gaps. Also, online databases that are open access are the main sources of data in this study. Solutions on how to address the gaps are also part of the scope in analyzing the literature. The study also does not attempt to cover other areas of TVET aside from the gender perspective, which is the highlight and contribution of this study to the field.

3. Objectives

This study aims to review, assess, and summarize the results and findings of research and studies on gender in TVET. The central question that directed the study is - "What are the gender gaps arising from the TVET literature and the solutions to address them?"

4. Methodology

For this study, inductive thematic analysis was conducted with MAXQDA. MAXQDA is a computer software program designed for qualitative and mixed methods data analysis. Thematic analysis was chosen because it is flexible, does not require comprehensive theoretical and technological knowledge of techniques, and is more accessible [17].

The flexible search strategy was used to support the themes in the literature. The exploratory design was chosen over the explanatory design because this study compares the similarities and differences between the available literature on gender gaps and the solutions to address them. The approach used to analyze and evaluate the data in the literature review is qualitative [18].

Twelve (12) articles were identified at the initial screening, and seven (7) articles were selected based on several criteria. The criteria were the following: a) published between January 2006 to December 2021 (fifteen years); b) include the concept of TVET gender responsiveness; and c) published in the English language. Solutions to bridge the gender gaps were also the focus of the review. The selected articles were obtained from various databases. These full articles are open access and purposive sampling was used with the keywords such as 'tech-voc gender,' 'gender gaps,' 'technical teachers,' and 'TVET gender.' Similar to Handa et al.'s [19] literature search, the search is made by title, abstract, and keyword using the keywords mentioned earlier, followed by removing articles that are only abstracts and not related to TVET gender.

Braun and Clarke's thematic analysis was used to analyze the data in this study, which included six phases of the inductive thematic coding process [17]. Using the software MAXQDA and the lenses of Braun and Clarke's thematic analysis, the content analysis started in step 1. The literature review was conducted - repeated reading on textual data and a memo was written during the coding process. In step 2, two codes were used in the inductive coding process to generate the initial codes. The first type of code is the gender gaps code and the second is the solution code. This process distinguished the data among the two initial codes. Next, in step 3, each was defined to search for potential themes based on the primary codes. Gender

gaps refer to the discrepancy in opportunities, status, attitudes, etc., between men and women in the TVET system. Moreover, the second code refers to the solutions to address the identified gender gaps. These provide clarity in the grouping of the data. In step 4, the potential themes were reviewed. Several pattern codes were identified inductively for possible themes based on the similar pattern identified from the initial coding. Some codes were combined and some were put under a mother code since they assumed the same pattern. Next, these themes are refined and defined in step 5. Several themes are classified as sub-themes as the answers are not directly answering the central questions. Data were then summarized and interpreted. Braun and Clarke [17] described the final step as producing a report. This report is presented below.

5. Results

Using the inductive thematic analysis, the following results have been derived:

5.1 Gender gaps

From the articles being reviewed, the final themes were generated. These practices among TVET systems are the main contributors to gender gaps.

5.1.1 Theme 1. Gender stereotyping: Challenges to inclusivity

Women and men have equal rights and opportunities to contribute to and benefit from national, political, economic, social, and cultural development. It is society's equal recognition of both the similarities and differences between women and men, as well as the various roles they play [20]. However, gender inequality, stereotyping, or biases happen when stereotyped qualities, roles, and actions are appointed to males/females. These may also occur when pre-judgment prompts gender separation such that lean towards one sex over the other [7]. This is true with technical-vocational education. Biases in gender also go inside the classroom. Some subjects seemed inclined to male or female sexes and vice versa. According to Pregoner et al. [7], learning environments were designed to meet a range of expectations regarding students' characteristics, traits, and family and career aspirations. Male students were expected to be conscientious, diligent, and responsible, but also insecure and prone to excessive stress. At times, teachers invoked physical strength to justify their views on unsuitable specialties for men.

The idea of 'gender roles' as a path to a future lifestyle and career was prevalent in TVET. Boys and girls enrolled in Tech Voc subjects, on the other hand, received immediate benefits and consequences. In Tech Voc subjects, the notion that girls should always be neat and well-dressed and boys should be rough and untidy became lived realities [10].

Gender stereotyping hinders the development of the female population, in the case of TVET, to better contribute to nation-building. When gender inclusivity to access educational opportunities is practiced, more females can become change agents. For this to be realized, first, there should be a significant change in the male/female enrollment ratio in school, particularly in vocational and technical subjects. Therefore, gradual but consistent strategies must be developed. Gender stereotyping perpetuates gender gaps in TVET because of expectations among the sexes. There are fields that are dominated by males or females due to stereotyping dictated by other contributing factors like culture, religion, school environment, and the individual processing of trainees/students. This stereotyping affects the potential of the male or the female to contribute to nation-building. Minimizing this gender gap in TVET through several efforts coming from different stakeholders can be equated to more beneficial and advantageous citizens, thereby contributing to economic growth.

5.1.2 Theme 2. Culture as a Factor of Gender Discrimination

The disparity/imbalance in male and female education stems from various cultural practices in society resulting from deeply entrenched prejudices, attitudes, customs, behavioral decisions, and procedures. And these factors add up to create discrimination against women's rights and educational opportunities. Religious and cultural practices that discriminate against women have existed for an extended period. Igbe [21] emphasized that the belief that women are God's creation with a weaker vessel and a shallow brain substantiated this point [22].

Sex-stereotyped male occupation over female occupation is a culture that has conditioned women to believe that it is taboo to enter a male-dominated occupation. This has undoubtedly impacted marriages, as women who pursue such vocations often struggle to marry.

Additionally, empirical research indicates that women in male-dominated fields may be disadvantaged by culture and their numerical disadvantage compared to their male counterparts [8]. Thus, the disproportionate composition may dictate the dynamics of the interaction that result in a numerical minority group gaining prominence and becoming aware of their overrepresentation.

Gender discrimination may also be visible in a variety of instances, in the form of institutional practices that are strongly influenced by cultural norms and beliefs, in the sense that women require protection, and thus rules are applied more strictly to them than to males. The same was aggravated in the field of TVET than in other areas in society. While a review of the literature and primary data collection revealed that policies are nondiscriminatory, it was also discovered that these policies are predominantly gender neutral and do not address the unique needs of female learners.

Cultural and structural barriers are the first impediments to gender equality, and overcoming them is critical. It is vital, if not sufficient, to focus exclusively on the structural context in which gender relations operate in schools, as these structures create apparent barriers to girls' participation and achievement, particularly at school [10].

5.1.3 Theme 3. Parenting styles influencing career choices

Ginzberg [23, as cited by 9] asserted that parents have a significant influence on their children's career choices. According to a study conducted with 3,971 respondents, the

primary influence on a child's career choice is his or her parents. This demonstrates that factors such as a father's career, prestige, and economic status are associated with and influence students' careers in an indirect manner. Parents have an important influence on their children's career choices. Masinire [10] also discovered that boys and girls were equally represented in Tech Voc subjects during the first two years of high school, with little regard for gender. However, as they progressed into their third year, they made a conscious choice to either dropout or continue. This is due to parental pressure.

Parents reportedly do not discriminate between daughters and sons, but the stigma associated with a girl working in physically demanding fields persists. These gender stereotypes frequently influence students' post-TVET employment status. This has a significant impact on students' specialization choices and explains why some domains continue to be dominated by one gender. This pattern is evident in the gender preference for particular specializations. According to the USAID Lebanon [32] study, some parents stated that their sons were discouraged from pursuing certain specializations. Similarly, even if female students are encouraged to pursue a male-dominated field of study, they should not work in the field but rather in the office. When asked why they chose their respective specializations, they cited three primary reasons: parental advice, personal preference, and the institute's recommendation.

As a result, parents must be educated about the importance of female education. This could be accomplished through mass mobilization campaigns utilizing a variety of media outlets (in indigenous languages) and the use of resource persons who are women in respectable positions in society. This is consistent with Bagshaw [24]. He asserted that women make superior leaders, passing on skills such as vision creation and expression, setting clear directions, taking charge, serving as an inspirational role model, setting high-performance standards, and assuming responsibilities. Adults should also participate in adult literacy programs because their involvement in the educational process encourages their daughters to attend school. Additionally, adult education will contribute to more rational and equitable distribution of educational resources among children, adolescents, and different social groups and a better understanding of economic equality and the sexes [22].

5.2 Solutions to bridge gender gaps

The following are the emerging themes from the TVET literature in addressing the gender gaps mentioned above. These are policy and guidelines, internship and career programs, community, and others.

5.2.1 Theme 1. Policy and guidelines towards equal TVET access and practice

Educational opportunities for women can be enhanced by formulating sound policies and guidelines [25]. The effects of these steps will be better and long-lasting than other ways to bridge gender gaps. The efforts should be concentrated not only on the school level but also on the governmental level. Rodgers et al. [25] added that the government should invest in workforce planning efforts that reward women for training for high-paying jobs in technology- and skill-intensive manufacturing industries. One of the most significant policy initiatives for advancing women in engineering and technical fields would be stricter enforcement of equal opportunity laws. More women will be encouraged to participate in the workforce that men often dominate.

Nurhaeni and Kurniawan [26] identified key components to help bridge the gender gaps in TVET. The first essential factor of mainstreaming gender is political will. The second is the political framework that should be manifested in the schools' regulations. Regulations should not be gender-biased. Structure and mechanism, resources, and infrastructure are also essential factors that can be improved by developing policies and guidelines. The organizational structure in schools should be gender-responsive. This is evident in the solid male dominance within the school's administrative structure and the organizational structure of school organizations such as the Intra-school students' organization, Boy Scouts, and teenage Red Cross.

Additionally, schools' infrastructures have been gender-insensitive. This is demonstrated by the absence of male and female toilet notices, a separate room for male and female students at the school health unit, and the absence of front covers on female students' desks. This increases the potential for female students' bodies to be exploited, resulting in sexual exploitation. These gaps could be easily influenced by developing gender-inclusive policies and guidelines.

Gender statistics are also effective sources of data to help understand gender differences and inequalities at all levels. These can be the springboard in developing education programs or activities for achieving gender equality in education. In most cases, schools already have data on the number of teachers by rank and position, the number of students by class and academic achievement, and the number of education personnel by rank and position. Thus, schools have owned gender statistics that could be handy in developing gender-inclusive policies and guidelines.

5.2.2 Theme 2. Internship and career programs as industry pathways

Career choice is important in sustaining a person in the TVET system. It is rooted and greatly influenced by the personality factor of the individual. Holland Theory [27, as cited by 9] stated that the degree of compatibility between an individual's personality and work environment determines his or her level of satisfaction, achievement, and ability. The theory entails the identification of personality traits that may be related to a particular occupational environment. He assumed that humans with various personalities will gravitate toward careers that fit their lifestyle. Thus, it is therefore imperative for TVET schools to develop internship and career programs aligned to the individual's personality factors.

Career guidance starting from the intermediate level in the elementary to the post-secondary level is helpful. Teachers, according to data, are the primary factor that influences students' career choices in technical fields. As a result, teachers have developed into a resource for students seeking information

about technical careers. Counseling teachers have a role in educating students about careers. Thus, a counseling teacher's role is to conduct career-related programs to guide students. Career counseling is necessary to assist students in determining their career path in the working world. As a result, the guidance department must develop a strategy for attracting female students and nurturing their interest in technical fields [9].

According to previous research, technical and vocational education reinforces the process of gender segregation in labor markets because the institutions' structures and cultures are geared toward a particular gender, reinforcing the male or female image of professions [28, 29]. According to this evidence, female students who enter educational spaces where they are a minority are impacted by the practices and discourses inherent in policy orientations and social structures that act as barriers to their participation in male-dominated areas and result in a much greater degree of reversion of their initial vocational choices than their male counterparts. In this regard, the high degree of gender segregation may represent a barrier to access and persistence in educational pathways that are not gender-typical for the student. This is consistent with the low proportion of female students who graduate with industrial specialties who pursue careers in those fields after completing their undergraduate degrees (35 percent of female students versus 80 percent of male students). Thus, TVET schools must reinforce internship and career programs that expose the students to industry. Complete understanding of the profession the students are heading to and the learner-centered career programs will help the students stay in the TVET program and pursue professions in the same field.

Masinire [10] noted a strong correlation between males' successful participation and the expectations placed on them in the public world of formal employment. They consider the opportunities available to them locally and internationally if they possess the necessary skills. Students frequently justified their involvement and participation in TVET by implying that their accomplishments would likely prepare them for the labor market. According to his research, male students often drop out of Food and Nutrition classes during their first two years of high school because they do not perceive the course as assisting them in achieving their future career goals. The same is valid with female students who enrolled in Metal Technology.

On the other hand, boys were more closely associated with Metal Technology. At the same time, girls were more closely associated with Foods and Nutrition, and these associations served as primary resources in gender performance. Simultaneously, they were aware of the environment they would enter after school. Metal Technology created opportunities for self-employment for those who acquired the necessary skills in the absence of formal paid work. The same skills were valued in South Africa and Botswana, where some boys envisioned future employment opportunities in these countries. The Voc-Tech curriculum exemplified an institutional structure in which normative gender regimes shaped young people's daily school experiences through these channels.

On that note, internship and career programs help students stay on the TVET track when it is rooted and aligned with personality factors. Moreover, the idea of the high-paying job in the future in the field of TVET helps them focus on the profession rather than on the gender stereotypes.

5.2.3 Theme 3. Community: Support system towards gender inclusivity

Despite policies and laws on gender equality, women still contend with discrimination and deprivation. Gender pay gap, under-representation in higher management positions, and slow and/or scarce women advancement in the field of work are quite apparent [30]. What seems more deplorable is the incidence of violence against women in the workplace, at home, and even in society at large [31]. Thus, in addressing the gender gaps, it is vital to have the community's collective effort.

The community or society, particularly the students' parents, are not fully aware of or understand the critical nature of gender-perspective integration into the educational field, including formal and informal education within families. This may result in discriminatory treatment and disadvantage to one of the sexes, particularly females.

Nurhaeni and Kurniawan [26] added that teachers, administration staff, and students have not known and understood gender within the school community. While principals and teachers have received gender training, they still lack an understanding of incorporating gender into school activities. They simply comprehend how males and females should treat one another. Their comprehension does not extend to the distinctions between men and women regarding authority, responsibility, and just rights.

Springing from how a child was raised by their parents and how the community within his/her personal space dictates gender roles affect the impending problems in gender gaps. Stakeholders within the society like the school, the church, the immediate and extended family members, even the environment where a child was being raised cover responsibility for the gender gaps. Thus, when these factors were addressed by information dissemination, modifying policies and guidelines, even trying to rectify a culture of non-inclusiveness, gender gaps may be alleviated.

6. Discussion

The literature review results on TVET practices revealed themes of gender gaps. The main themes are gender stereotyping: challenges to inclusivity [7, 10, 20], culture as factor of gender discrimination [8, 10, 21, 22], and parenting styles influencing career choices [9, 10, 22, 23, 24]. In addressing these gaps, the literature revealed that the main themes are the formulation of policy and guidelines towards equal TVET access and practice [25, 26], effective internship and career programs internship and career programs as industry pathways [9, 10, 27, 28, 29], and community: support system towards gender inclusivity [26, 30, 31].

Gender inequality, stereotyping, or biases are still happening in the TVET system. These biases even reached the classroom, where learning is compromised just because of

gender expectations [7]. Having this gender gap existing continues to cause a particular imbalance in the supply of both sexes in the workforce. This does not only affect the number of workers but as well the welfare of the minority. Moreover, gender stereotyping also leaked into the industry. This makes the gap more problematic. The TVET literature mapped that the gender gaps are rooted in people's various cultural practices and ideologies. Deeply fixed prejudices, attitudes, and customs boxed the individual and hindered the development of his/her full potential [22]. In addition, culture is associated with the parenting styles among TVET students/graduates. It is clear that parents significantly influence children's career choices [9]. Since parents are driven by certain cultural practices that are non-inclusive, gender, predominantly female, are discouraged from pursuing TVET.

However, gender gaps can be addressed by various means to minimize the disparity. As enforced by memoranda, laws, or resolutions, policy and guidelines can open access and opportunity for all sexes [25]. Policy and guidelines also produce budgets that are most of the time a problem in TVET. Though it may sound compelling, still, it is an external force that commands people to follow. Internal forces are still better options to drive out biases and prejudices. One effective way to instill the importance of inclusivity into TVET is through internship and career programs [9]. With that, the value of the TVET program can be laid out to the students so that they may develop a passion for pursuing TVET. When policies and guidelines back up these moves, it will be easy to integrate those into the curriculum. As a collective effort, the community and other stakeholders of the school can be a great addition to push for gender equality advocacy.

Thus, even if there are existing gender gaps, there are also solutions to bridge them. Though there are so many efforts in minimizing the gaps, still, those gaps pose challenges and problems that keep TVET from improving. The reality that TVET is the cradle of the workforce of any country is still the reality that can help countries be developed towards economic progression and stability.

7. Conclusion and Recommendations

This exploratory research via literature review derived that the arising gender gaps in TVET literature are gender stereotyping: challenges to inclusivity, culture as factor of gender discrimination, and parenting styles influencing career choices. In addition, the solutions emerging in TVET literature for gender gaps include policy and guidelines towards equal TVET access and practice, internship and career programs as industry pathways, and community: support system towards gender inclusivity.

Following the study's conclusions, this research recommends further inquiry into the gender literature of TVET since there is a limited number of readings available in the field. The findings of this study can also be used as baseline data in developing policies and guidelines that will help address the impending problems of the TVET system. TVET institutions should craft and modify existing written curricula adhering to the gender gaps identified in this study. The TVET instructors, teachers, and trainers are recommended to pursue changes in the curriculum implementation to make TVET more inclusive and encompass gender. A gender-responsive curriculum implementation framework should be developed to effectively translate inclusivity into the teaching and learning processes. With the changing and updating nature of the industry, further study on the same nature should be pursued to keep TVET institutions gender-sensitive and gender-responsive.

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