

# The Development of a Measurement and Assessment Model for Elderly Distance Education Students at Sukhothai Thammathirat Open University

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## Abstract

*This research study aimed to investigate the opinions of elderly students on distance education measurement and assessment at Sukhothai Thammathirat Open University, and develop a measurement and assessment model for elderly distance education students at Sukhothai Thammathirat Open University. This is a research and development study consisting of two phases. The first phase, which investigates the opinions of elderly students on learning measurement and assessment, consists of two steps: (1) a quantitative examination of the opinions using a questionnaire and stratified random sampling method covering all fields of study, and (2) a qualitative examination of the opinions through in-depth interviews. The second phase, which involves the development of a learning measurement and assessment model for elderly students, consists of two steps: (1) interviews with two focus groups involving 15 experts and 10 service staff involved in providing service to the elderly students, and (2) a measurement of the quality of the developed model. In conclusion, the model comprises assessment as learning, assessment for learning, and assessment of learning based on the standards of the bachelor's degree curriculum. However, to ensure consistency with and cater to the natural conditions of elderly students, the assessment requires following adjustments: decrease item numbers in multiple-choice tests, enlarge the font for written tests, and use recording tapes or clips to record answers. In the future, short courses appropriate for elderly students could be introduced based on the modular structure of a bachelor's degree curriculum to benefit credit transfer.*

**Keywords:** *assessment of 21st century skills, distance education, elderly students, evaluation, measurement and assessment model, open university*

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## 1. Introduction

The world continues to experience an unprecedented and sustained change in the age structure of the global population, driven by increasing levels of life expectancy and decreasing levels of fertility. People are living longer lives, and both the share and the number of older persons in the total population are growing rapidly. Globally, there were 727 million persons aged 65 years or over in 2020. Since women live longer than men, on average, they comprise the majority of older persons, especially at advanced ages. Over the next three decades, the number of older persons worldwide is projected to more than double, reaching over 1.5 billion in 2050. All regions will see an increase in the size of the older population between 2020 and 2050. Globally, the share of the population aged 65 years or over is expected to increase from 9.3 percent in 2020 to around 16.0 percent in 2050. (United Nations, 2020). In Thailand,

the Ministry of Social Development and Human Security (2020) reveals that Thailand has been growing into an aging society since 2005, with 10 percent of the country's population comprising people of old age. Thailand has become a complete aged society; by 2021, the old age population has increased to 20 percent, and this figure is expected to reach 30 percent by 2035. Thus, in Thailand the elderly are encouraged to engage in self-development to keep up with social change, gain professional skills, and improve their quality of life. A portion of Thai elderly people are becoming increasingly interested in returning to formal studies. At Sukhothai Thammathirat Open University (STOU), an open university focused on providing distance education and emphasising lifelong education and learning for people of all genders and ages, there is now a greater number of elderly students showing interest in obtaining bachelor's degrees.

Elderly students in the distance education system who are registered in bachelor's degree programmes at STOU experience learning and assessment problems, which comprise the following two aspects: (1) problems of physical and brain conditions, especially decreased memory, slow-thinking brain, blurred eyesight leading to reading difficulties, poor health and congenital diseases, and (2) problems in measurement and assessment, such as choosing wrong answers, slowness in writing subjective responses, difficulty in reading small font of test questions, difficulty in understanding questions, problems with difficult and complex tests, and inability to finish tests in time. These issues are evident when STOU uses the same measurement and assessment model meant for all students, which thus affects the academic achievement of elderly students. Currently, STOU has measurement and evaluation models for normal, autistic, and disabled students, among others. However, even though these measurement and assessment systems emphasise examination as a way to determine results or grades as the main concept of assessment, this does not appear suitable for elderly students.

## 2. Literature Review

### 2.1 Andragogy as the Adult Learning Theory

Knowles (1984) developed the Andragogy Theory, which concerns learning among adults. The theory confirms that adults are able to learn independently; as a result, the learning curriculum for adults must be consistent with each person's basic conditions. This includes designing learning activities for adults by rationalising why they have to learn some specific issues, from cumulative real experience, to solve problems or in real situations, and content that is useful for survival.

Applications of andragogical principles in general higher education are deemed promising. Thus, adult learning experts support the formal teaching of andragogy to university administrators and staff members (Tannehill, 2009; Chan, 2010; Yow, 2010; Caruth, 2014). Educators are also encouraged to apply andragogical methods to help students become competitive in modern workplaces (Chan, 2010; Caruth, 2014). Moreover, if adult learners indeed make up the fastest-growing segment in education, then private institutions would certainly find it profitable to cater to the needs of these specific individuals.

In addition, Ratana-Ubol (2016) explained educational gerontology, which integrates philosophy, principles, and teaching methods for adults, and combined with elderly, medical, and social sciences to develop teaching models for older adults to serve these five basic needs: knowledge for social adjustment, knowledge transfer to the society, the understanding social possibility for the ability of social participation, self-development, and life satisfaction. Educational management goal for the elderly should take into account understanding of natural processes and changes during senility, protecting and taking care of self, and development of persons who can participate well in society.

Knowles (1984) defined "science and art helping the elderly to learn" as: (1) a self-concept, which is self-leading in learning, (2) an experience, a valuable learning resource, (3) readiness, development in career and social roles, and (4) orientation to learning, focusing on immediate implementation and problem-based learning. Furthermore, Ratana-Ubol (2016) indicated that supporting components for learning among the elderly are readiness, internal and external inspiration, positive attitude, needs and interests, former experience, practice and repeat until become proficient, ability to know own progress and

mistakes for improvement and encouragement, teachers' courage, and appropriate use of various teaching techniques and activities.

Moreover, in studying learning and memory, Sumalrot and Suksawai (2015) found that both these aspects deteriorate as one reaches 70 and older. The severity depends on individual intellect, education, inspiration, attention, and other factors. However, the elderly are still able to learn new things related to previous experiences they have gained over a long period, and could learn well and fast if it concerns learning specific issues flexibly. The elderly tend to have long-term or remote memory, but may face difficulties with their short-term or recent memory. However, memory activation among the elderly can be improved with steps such as writing, enlarging the font, using colours to activate eyesight, avoiding repeated questioning of issues they could not remember, and using recording tools.

## 2.2 Concepts of Measurement and Assessment in the 21st Century

The approach to learner measurement and assessment in countries such as Canada, Britain, Singapore, and Hong Kong have adjusted to focus on development, integration, and balance between formative and summative assessment emphasising expected outcomes. Based on the concepts of measurement and assessment in the 21<sup>st</sup> century, teachers have to intensively integrate measurement and assessment into teaching, especially novice measurement and assessment that focus on achieving results that are geared toward developing learning management appropriate for individual learners, including encouraging them to realise their strengths and weaknesses so that they can set appropriate learning goals and become inspired to develop themselves to achieve those goals (Dylan, 2011; Ngudgratoke, 2013; Masathienwong, 2013). Moreover, Sangprateptong (2013) and Berry (2008) explained the three objectives of learning assessment in the 21<sup>st</sup> century, which are summarised as follows:

- i. Assessment *as* learning (AAL), which involves collecting empirical data about students' learning, while encouraging their learning awareness. Assessment is conducted once the students have assessed themselves on what they know, what they do, and what new things they have learnt. Encouraging students to design learning plans and strategies enables them to continuously develop themselves. This assessment is called formative assessment. Dylan (2011) implemented formative assessment in five strategies: (1) clarifying, sharing, and understanding learning intentions, (2) engineering effective discussions, tasks, and activities that elicit evidence of learning, (3) providing feedback that moves learners forward, (4) activating students as learning resources for one another, and (5) activating students as owners of their learning.
- ii. Assessment *for* learning (AFL), which involves diagnosing the students' learning problems, and improving their learning or working methods towards the development of individual learners. The main concept for AFL is classroom assessment during the process of teaching and learning. Interaction between teacher and students is highly emphasised through asking questions, encouraging critical thinking and listening, and prompting reflective answers from the students. This is also a form of formative assessment.
- iii. Assessment *of* learning (AOL), which involves deciding on the students' learning, and how much their learning matches the achievement of curricular standards. In AOL, teachers play the main roles in assessment. This is a form of summative assessment (Sangprateptong, 2013, p.6-10).

The Andragogy Theory helps to frame this study by taking into account self-concept, learning experience, readiness to learn, orientation to learning, and motivation to learn, as well as concepts of measurement and assessment that are appropriate for older students in a distance learning mode. In addition, the use of concepts of assessment in the 21<sup>st</sup> century can help to develop an appropriate measurement and assessment model, specifically one that is more suited to the natural conditions of the elderly. Such development can support their achievement, and ensure quality assurance of the university's distance education mode.

The objectives of this research study are to: (1) investigate the opinions of elderly students on distance education learning and assessment at STOU, and (2) develop a learning and assessment model for elderly distance education students at STOU.

### **3. Research Method**

This study aims to develop a suitable measurement and assessment model for elderly distance education students at STOU. The research procedures were divided into the following two phases:

#### **3.1. Phase I: To investigate the opinions of elderly students on distance education learning measurement and assessment at STOU**

Data collection in this phase was divided into the following two studies:

##### ***3.1.1. Quantitative Study***

The elderly students' opinions were obtained through a questionnaire. The population of the study comprised 595 students aged 60 years and older enrolled in any bachelor's degree programme at STOU in the 2016-2019 academic years. The research sample comprised 240 students selected using the stratified random sampling method. The questionnaires, invitation letters, participant information sheets, and letters of consent were sent to these 240 students, and they voluntarily answered the questions.

The sample size was determined using the formula developed by Yamane, 1973. The 240 students selected by stratified random sampling method were categorised according to their study programmes, which consisted of 12 study programmes from the School of Agriculture and Cooperatives, Law, Management Science, and others.

##### ***3.1.2. Qualitative Study***

In-depth interviews were conducted with elderly students who were close to the point of graduation and had learning plans and preparations. The interviews examined factors influencing successful learning or passing in each course as well as other aspects to gain in-depth information useful for the development of the model in the second phase.

This study analyses and concludes the research results from both the quantitative and qualitative components to develop a draft model that is suitable for elderly distance learning students at STOU.

#### **3.2. Phase II: To develop a learning measurement and assessment model for elderly distance education students at STOU**

This study develops a model considered by experts and support or service staff who are involved with elderly students. This phase consists of the following two steps:

- i. Arranging a focus group on 24 August 2021 with 15 experts and 10 service staff to obtain suggestions beneficial for the development of a model appropriate for elderly students, and
- ii. Confirming the quality of the model based on the findings of the focus group, sending the developed model to experts to confirm its quality in four aspects: usefulness, possibility, appropriateness, and accuracy, using the experts' suggestions to make adjustments until an appropriate model is developed, and finally, obtaining confirmation for the model by university administrators who make assessments and suggest improvements until the model is deemed suitable.

## 4. Findings

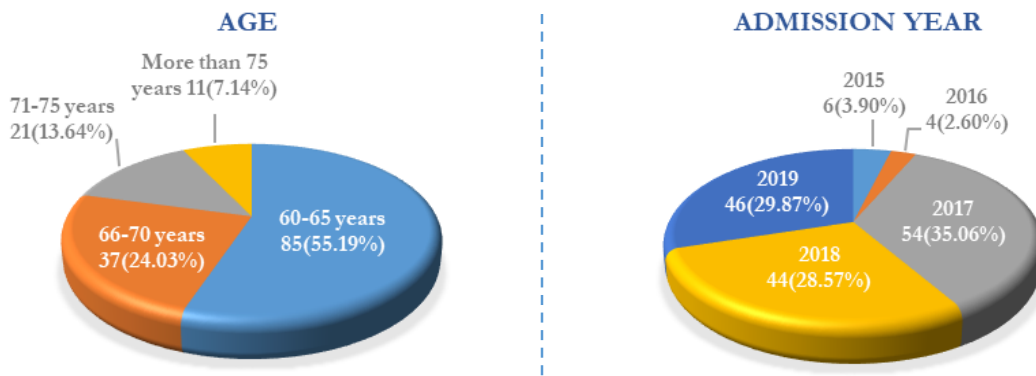
The research findings are described in the following two sections:

### 4.1. Findings of elderly students' opinions on learning measurement and assessment

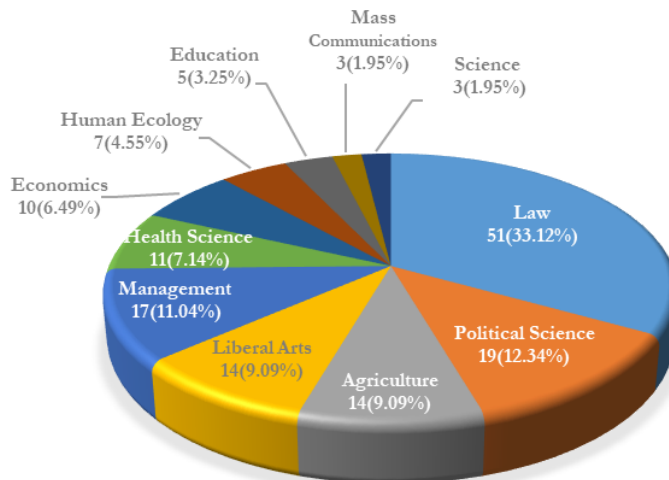
#### 4.1.1. Results of the Quantitative Study

A questionnaire was used as the quantitative instrument for obtaining and investigating the opinions of elderly students on learning measurement and assessment. The questionnaires were sent to a sample of 240 elderly students. 154 students responded, representing 64.17 percent of the sample.

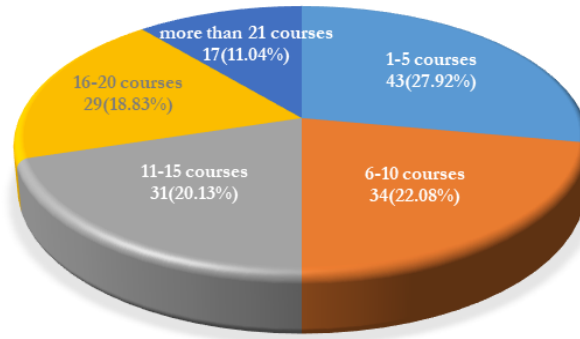
The general information of 154 samples obtained from the questionnaires revealed that 55.19 percent of the respondents were aged 60-65 years, while 24.04 percent were aged 66-70 years. A total of 35.06 percent had entered to study at STOU in the 2017 academic year. A high percentage majored in law (33.11 percent) and political science (12.34 percent). These elderly bachelor's degree students were already registered for 1-5 courses (28.57 percent) or 6-10 courses (22.08 percent). Their reasons for being interested in studying through distance education were getting involved in lifelong learning (84.14 percent), and updating and adjusting themselves to social change (73.79 percent). Almost all students learned from course materials (99.31 percent), and from exercises contained in the course (71.72 percent).



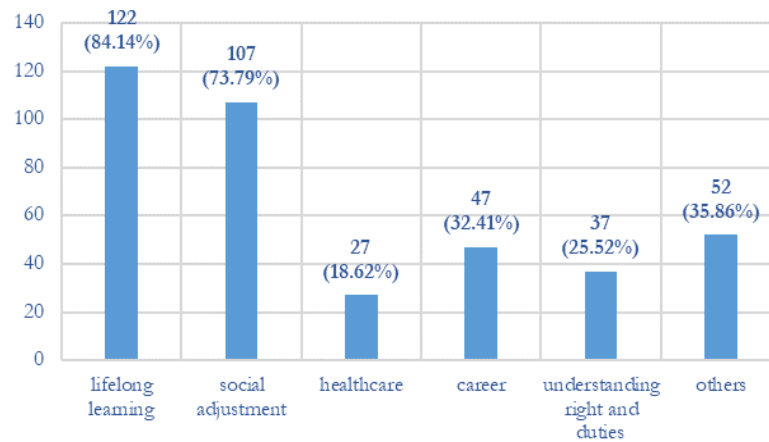
#### FIELDS OF STUDY



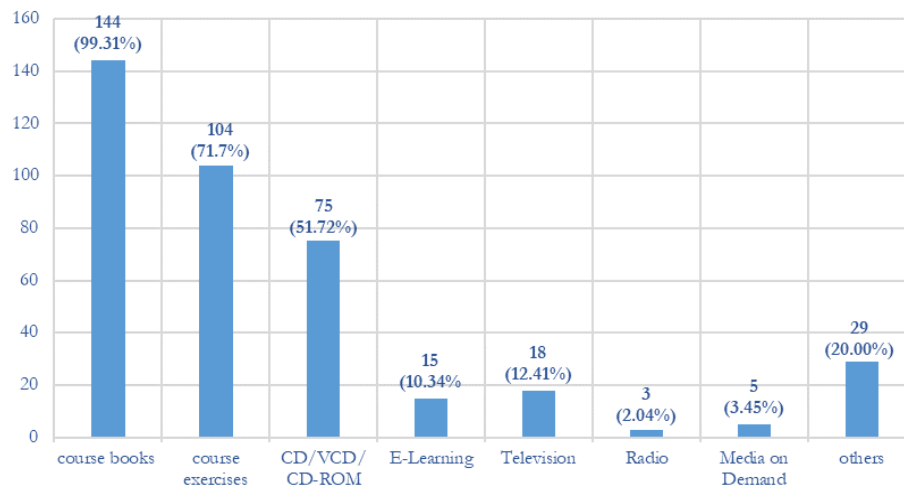
**NUMBER OF REGISTERED COURSES**



**GOALS FOR STUDYING  
 IN DISTANCE EDUCATION**



**LEARNING MEDIA**



**Figure 1.** The general information of the respondents in this research

Conditions and opinions on learning measurement and assessment:

- i. Problems during studying through the distance education system of STOU: Most of the respondents (71.33 percent) had difficulty remembering the course content due to the large number of course units. Some (37.76 percent) reported that understanding the course content required a lot of time, while others reported that they were unable to finish reading all the units of their registered courses (33.57 percent), and obtained their course books late (27.97 percent).
- ii. Problems in examination or measurement and assessment through the distance education system of STOU: The majority of respondents stated that the questions were too difficult, too long, or too complicated, which demanded a longer time for revision (50.35 percent), and that they forgot the learnt content (33.33 percent), and had been unable to finish tests in time (21.28 percent).
- iii. Factors influencing elderly students' learning: Most respondents did pre- and post-tests and practice activities at the end of each chapter (84.03 percent), planned reading and continuously read all unit content (70.14 percent), re-read to revise important issues (63.19 percent), and used reading techniques or summarised important issues to improve understanding (62.50 percent).
- iv. Appropriate learning measurement and assessment model for elderly students in the distance education system: Most respondents (56.46 percent) thought that the most appropriate components of the model were the pre- and post-tests, co-learning activities (getting cumulative scores), midterm and final examinations.
- v. Characteristics of the appropriate test for elderly students: The respondents suggested that test questions should be shorter and less complicated (65.96 percent), have difficulty levels that are appropriate for elderly students (46.81 percent), have adjusted testing duration or item numbers so that the students could finish in time (34.75 percent), and have enlarged font sizes to ease eyesight (34.04 percent).
- vi. Experience in participating in extracurricular activities provided by the university: Most respondents had never participated in any extracurricular activities because of the Covid-19 pandemic, and health and travelling issues (37.50 percent). Some reported they used to participate in extracurricular activities to obtain cumulative scores (29.86 percent), professional training/intensive training courses (27.08 percent), and curricular activities via other channels such as radio, television, and YouTube (19.44 percent).
- vii. Opinions on learning measurement and assessment in the distance education system: The respondents' opinions on measurement and assessment yielded high scores ( $M = 3.67$ ,  $SD = 0.68$ ). Specifically, the study found that AAL received the highest mean score ( $M = 3.95$ ,  $SD = 0.61$ ), followed by AFL ( $M = 3.05$ ,  $SD = 1.36$ ), and AOL ( $M = 3.88$ ,  $SD = 0.70$ ).

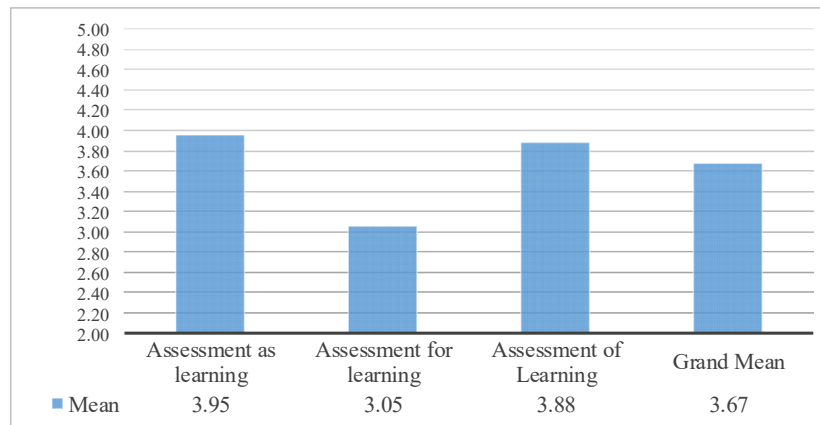
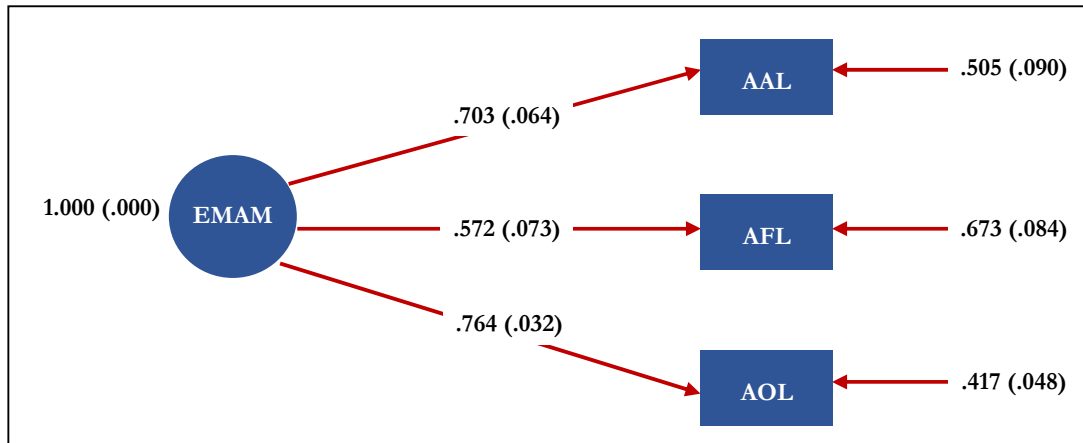


Figure 2. Scores for the different measurement and assessment components in the distance education system

Testing the construct validity, i.e., whether a relationship exists between the observed variables and their underlying latent construct, was also performed. The construct validity was assessed using a confirmatory factor analysis. The observed variables were AAL, AFL, and AOL, while the latent variable was the elderly measurement and assessment model (EMAM). The result of the multilevel causal analysis found that

$\chi^2 = 0.5450$ ,  $df = 1$ ,  $p = 0.7956$ ,  $\chi^2/df = 0.5450$ , CFI = 0.967, TLI = 0.936, RMSEA = 0.007, and SRMR = 0.005, which implied the appropriate fit of the model. The result indicated that all latent variables had construct validity.



Note.  $\chi^2 = 0.5450$ ,  $df = 1$ ,  $p = 0.7956$ ,  $\chi^2/df = 0.5450$ , CFI = 0.967, TLI = 0.936, RMSEA = 0.007, SRMR = 0.005

**Figure 3** Results of the construct validity test using a confirmatory factor analysis

#### 4.1.2. Results of the Quantitative Study

Based on the three components of learning measurement and assessment, the results are described as follows:

##### 4.1.2.1. AAL: Checking Self-learning

The respondents revealed that doing pre-and post-tests, as well as reading content doing course activities are useful methods for elderly students to learn by themselves. They also help elderly students better understand course content, and serve as guidelines for doing tests during examinations. They suggested an increase of pre-and post-test items from 10 to 20 items, that pre-and post-tests should be made parallel, and that assessed content should be specified, with 60 percent for unit content and 40 percent for challenging questions. At least five items should be provided as clues for written tests in the last part of unit exercises to help guide the elderly students.

##### 4.1.2.2. AFL: Adjusting and Developing Learning

The respondents thought that extracurricular activities/extra classes for cumulative scores/extracurricular activities of the curriculum enable the elderly students to better understand the course content and allow them to adjust to learning. Moreover, they thought that all courses should provide extra classes both online and onsite, especially for difficult courses such as the major of statistics and law, and that written tests may be too difficult for self-study, i.e., there should be opportunities to exchange ideas and ask questions when necessary, and that various extracurricular activities through such options as tapes/Facebook Live/Internet/E-learning should be arranged to take into consideration elderly students with health and travel problems. They also thought that cumulative scores should be increased from 20% to 30% even for activities or written reports, and questions and extra classes should provide ways for the elderly students to ask questions and obtain suggested answers, including summaries of course content.

##### 4.1.2.3. AOL: Judging learning results

- i. Summative assessment: This should include midterm and final examinations or K2 for all courses to mitigate the problem of remembering content, as most elderly students have problems with health, memory, and using their eyes for more than an hour. All this affects learning achievement.
- ii. Test: Questions should be less complicated, not confusing, shorter, and have reduced difficulty levels. This is to suit the conditions of elderly students, who often have vision problems, especially when they have to spend a long time trying to understand questions, and have memory problems



- as well, in addition to being unable to read for comprehension, and manage time well. Moreover, test questions should use understandable language, and not focus on memory and recall. Written tests should not include more than 100 items, but should have a passing mark of 50 percent. The number of written tests should be decreased as elderly students have a tendency to fail them, especially tests requiring recitation of laws. Instead, written tests should link to daily experiences, and include fonts that are large and bold.
- iii. Time duration: The duration of tests should be adjusted as elderly students often fail to finish them in time, nor could they write all the answers as expected. These students take too much time to do and analyze the tests, which causes exhaustion and renders them ineffective.
  - iv. Examination hall: There should be specific physical provisions for elderly students, including suitably sized desks and chairs, and sufficient lighting and air circulation using fans. Examination halls should be on the ground floor of any building so that elderly students could avoid taking the stairs.
  - v. Test report: a declaration sent by post was delayed. Although students can check their grades through the online system, most elderly students are not skilled at using information technology.

Proper coordination should provide channels to help and facilitate elderly students to ask questions or obtain easily understandable information. Communication with elderly students should mainly involve hard-copy documents. Although online channels are generally easily used and accessed, most elderly students are less skilled at using information technology, and have problems with sending and receiving materials, as well as searching for PDF files or e-learning in general. The instant communication app LINE is a good channel for elderly students to obtain services as it is easily accessed. Steps for registration or other instructions should be given in infographic form, with guided steps that could be easily understood.

Consultation and assistance should be provided through advisors who can give suggestions and encourage learning of elderly students. Tutorial classes for idea exchange between students and teachers should also be provided. In this context, the Academic Resources and Community Engagement Centre has an important role to play in better catering to the needs of elderly students.

#### **4.2. Findings on the learning measurement and assessment model for elderly distance education students at STOU**

##### ***4.2.1. Opinions of experts towards the development of the model***

According to the focus group discussion involving 15 experts and 10 staff involved in providing services to elderly students, the experts stated that elderly students have enrolled at STOU in various bachelor's degree programmes at an age when they are experiencing deterioration in all aspects, especially memory, mental prowess, and physically as well. If the standard measurement and assessment model meant for all common students is applied to elderly students, their learning achievement will certainly be affected. Although the goal of educational management at STOU is educational management for people, the university's measurement and assessment approach has not specifically emphasised aging or elderly students, so there have been no adjustments to respond to their natural conditions. As a response to this, the experts suggested the following two potential solutions:

Solution 1: The learning measurement and assessment model for elderly students at STOU has been developed based on the bachelor's degree curriculum. Some parts should be adjusted to be more flexible and consistent with the needs of the elderly students. For example, the number of multiple-choice tests could be decreased, time duration adjusted and font sizes enlarged. Elderly students could also be allowed to provide answers via recorded tapes/clips, as their age may not afford them the endurance to sit for tests comfortably. These steps would enable a more appropriate measurement and assessment approach for the elderly students.

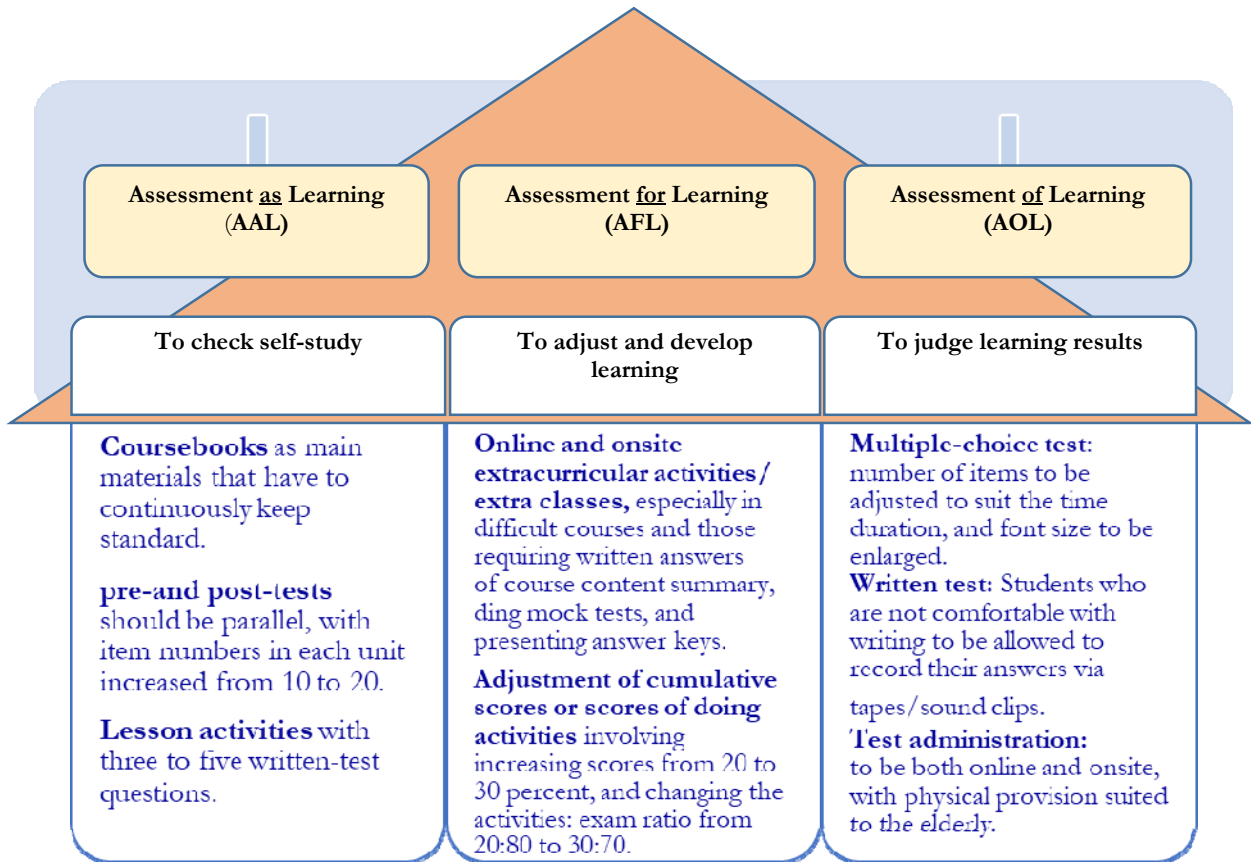
Solution 2: There should be a model for short course development to serve elderly students in the future as their number seems to be increasing. It is therefore a good opportunity for the university to develop short courses that are suitable for their natural conditions, and these could be in the form of modular

courses leading to certificate award. However, these course must be based on the bachelor’s degree curricular structures so the students can collect and transfer credits obtained through short courses into any bachelor’s degree curriculum, which is beneficial for elderly students who aspire to graduate from a full-fledged bachelor’s degree programme.

**4.2.2. Summary of developed learning measurement and assessment model for elderly students**

The findings of the focus group are used to develop a measurement and assessment model that is then presented to experts who examined its quality. The researcher subsequently adjusted the model based on the experts’ suggestions to yield a more appropriate model, as can be seen in the two models below:

Model I: As the model was developed based on a bachelor’s degree curricular structure, the basic structure of this model maintains the educational standard of a bachelor’s degree programme, with adjustments made to certain aspects so that it could be more flexible and acknowledge the natural conditions of the elderly students.



**Figure 4.** The measurement and assessment model for elderly students in distance education at STOU

Model II: A short course model to serve prospective elderly students was also developed to respond to the increase in the elderly student population. This is considered a good opportunity for the university to develop short courses that can suit the natural conditions of elderly students by adjusting the curriculum, designing teaching and learning activities, and appropriately measuring and assessing their learning. The short courses could integrate content from a bachelor’s degree curriculum but spread into smaller modules. This is to ensure their potential usefulness for credit transfer.

## 5. Discussion

The measurement and assessment model for elderly students consists of AAL, AFL, and AOL. This is consistent with Dylan (2011); Berry (2008); Ngudgratoke (2013); Masathienwong (2013); and Sangprateptong (2013) who stated that these components are the objectives of learning assessment in the 21<sup>st</sup> century, as detailed below:

### 5.1. AAL: To Check Self-Study

As the main media used by the elderly students to keep track of their learning, course books must be kept up to standard, especially in terms of content accuracy, modernity, and consistency between course content and assessed issues. Pre- and post-tests should be parallel, and include more questions. Activities at the end of each unit, specifically in courses that involve written tests, should have guided questions and answers for three to five items, and the veracity of the answer key should also be checked. Knowles (1984) explained in his Andragogy Theory that adults can learn by themselves, while Sangprateptong (2013) and Dylan (2011) stated that AAL involves assessing the self about what has been learnt, what is used for planning lessons, and specifying learning strategies to continuously encourage self-learning development.

### 5.2. AFL: To Adjust and Develop Learning

Extracurricular activities/extra tutorial classes enable students to better understand course content, and encourage learning adjustment and development among elderly students, especially in difficult courses. There should be increased opportunities for students to exchange ideas or ask about course content to facilitate understanding. Additionally, the cumulative or activity scores could be adjusted from 20 to 30 percent, or the activity: exam ratio adjusted from 20:80 to 30:70. Ngudgratoke (2013) stated that formative assessment is conducted between teachers and students during study sessions to obtain feedback for teachers' teaching and students' learning adjustment, and Sangprateptong (2013) and Masathienwong (2013) confirmed that AFL is an assessment to diagnose students' learning problems so that learning methods could be adjusted or learning methods of individual students could be developed, as well as to encourage students to identify their strengths and weaknesses.

### 5.3. AOL: To Judge Learning Results

Designing a measurement and assessment approach that still maintains the standard bachelor's degree curricula requires adjustments so that test can be more flexible or correspond with the natural conditions of elderly students. These adjustments should include decreasing the number of test items, enlarging the font size, decreasing the number of test items related to assessing recall skills, and allowing recording using tape or sound clips as a way of answering questions in written tests. These take into consideration how elderly students usually spend a long time to complete their tests, and may slower with writing and thinking. Ngudgratoke (2013) and Berry (2008) indicated that summative assessment is a post-learning assessment approach to examine students' knowledge of how much they have gained from a course, while Sangprateptong (2015, p.6-10) confirmed that AOL means judging the results of learning, i.e., how much students achieve based on the curricular standard, and teachers play a major role in the process called summative assessment.

Previous studies using the same measurement and assessment model meant for all students show that this will affect the academic achievement of elderly students. Measurement and assessment systems emphasising on examinations as a means to judge learning outcomes may not be suitable for elderly students who may suffer from decreased memory. Therefore, the measurement and assessment model developed through this study is considered suitable for the natural conditions of elderly students and could further support their achievement in learning.

This study found that elderly students experience significant learning problems, such as decreased memory and slow-thinking brains, especially when they are required to read a lot of text for learning. Therefore, this study suggests that elderly students are supplied with content summaries, or given training in the use of diagrams, mind maps, or concept mapping to help them gain better understanding of the course content. For the development of a future measurement and assessment model, STOU should emphasise the concepts of assessment in the 21st century and authentic assessment based on the natural conditions of students. This is to take into consideration the fact that the university has a diverse student body, and every student is different from others, especially the elderly, disabled, and disadvantaged.

## 6. Conclusion

This research study aimed to investigate the opinions of elderly students on distance education measurement and assessment at STOU, and develop a measurement and assessment model for elderly distance education students at STOU. In conclusion, by investigating the opinions of elderly students, the study found that most elderly students experience problems related to inability to remember course content, and that the most appropriate model for elderly students should comprise pre- and post-tests, co-learning activities (for obtaining cumulative scores), midterm and final examinations. However, the item in the test items should be made less complicated and shorter. However, the developed measurement and assessment should be composed of AAL, AFL, and AOL, and be based on the standards of a bachelor's degree curriculum that be adjusted to better correspond with the natural conditions of elderly students. These adjustments could include decreasing the number of multiple-choice test items to better suit the time duration, enlarging the font in written tests so that text is easier to see and read, and allowing elderly students to record their answers using tapes or clips. Short or modular courses that are appropriate for elderly students could be developed based on the modular structure of a bachelor's degree to facilitate credit transfer. The application of the measurement and assessment in the 21st century, and the Andragogy Theory, a new measurement and assessment model in the distance education system was developed to suit the natural conditions of elderly students and support their learning achievement.

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