A Place-Based Digital Learning Environment with Learning Resources Applications to Enhance Student Learning and Innovations

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Abstract—Sustainable development goals has underlined the relevance of education and culture in specific areas. Seeing as place-based learning has been shown to be a successful community-oriented approach, this study was designed to combine the participation of people in context-based specifics in order to develop a local-wisdom learning-management model with digital resources applications for learners enclosed in Thailand's educational innovation sandbox. 146 key information providers, and 340 students, from two elementary schools and two secondary schools, took part in the research and related development process. The results indicated that a local-wisdom learning-management model could enhance each student's learning achievements as well as boost his/her learning and innovation skills. Key involved persons, learning-management goals, local-wisdom content, and digital learning resource applications are the four most critical components. In addition, the model covers five steps of learning procedures, and three evaluation methods. Practical implications towards future policies and practices are also discussed.

Keywords—place-based education, local wisdom, educational sandbox, learning and innovative skills, digital learning resources

1 Introduction

Sustainable Development Goals (SDGs) stress the influence of culture, education, and innovation as the most critical attributes. By employing creative resources, SDGs have the potential to contribute to long-term development. Quality education (SDG 4) emphasizes a place's and community's unique characteristics. Furthermore, climate action (SDG 13) emphasizes the relevance of local knowledge of ecosystem management, natural resource extraction, and local material [1] with the goal of promoting sustainable livelihoods. Regions must create their place-based policies [2] in order to implement such plans, because there is no "one-size-fits-all" regarding regional capacities relating to political, economic, and social contexts. In addition, regional innovation systems could be used to design activities that make the best use of the available cultural base of social innovation resources, and to secure resources for future activities [3]. It could

lead to collaboration between both cultural and creative industries, with the aim of combining heterogeneous sources of knowledge [4].

Previous studies reported the need for a sustainable and smart product innovation ecosystem within 'society 5.0' in order to reduce economic and social gaps and cultivate a more human-centered society [5]. Research and development are currently employed solutions for boosting market competitiveness in the innovation ecosystem – through collaboration with institutions, the research sector, and individuals with the goal of producing co-innovation [6]. To promote this idea, [7] highlights the education sector as it is engaged by the national economic and social development plans requirements.

In order to meet these requirements, a pedagogical concept referred to as 'place-based education' which emphasizes student engagement within context- specifics. With community-based learning experiences more widespread place-based structures and processes within the educational system – as well as collaboration between them – need to be addressed in order to sustain local cultural and natural environments [8]. Place-based educators might be 'change-makers' who effectively possess locally positioned geographic, ecological, cultural, and historical learning [9], [10].

During the past few years, amidst the Covid-19 pandemic, it was critical to engage students within the parameters of their own culture and to establish compelling digital learning environments. It was essential to combine real-life settings and pedagogical processes within the compass of possibilities offered by mobile technology in order to achieve authentic learning [11]. To bridge the gap between cultural and creative industries, innovative learning was needed to combine heterogeneous sources of knowledge. Available resources were made the most of in order to produce more creative activities. This research seeks to develop a local-wisdom learning model with a digital learning resources application incorporating well-established components within the educational sandbox. The study also looks into using applications to encourage the development of learning and innovation skills. We also highlighted practical implications on regional education policies, in particular.

In order to enhance learners' achievements in knowledge, competence, skills, and attitudes, this study aims therefore to reduce inequalities in education, by decentralizing and allowing independent educational spaces and institutions. Researchers perceive advances in information and communication technology to be of practical use. In conjunction with the COVID-19 epidemic, electronic educational applications were developed which facilitated effective knowledge transfer – during the process of which, learners were able to develop innovative learning skills appropriate for 21st century living. They did this through participating in local-wisdom learning-management activities, while applying digital learning concepts such as: (1) critical thinking and problem-solving; (2) communication; (3) collaboration; and (4) creativity and innovation. The research theoretical framework is presented in Figure 1.

Within the context of this study, the 'educational Sandbox' is defined as a specific educational area in which local people are allowed to establish educational principles and organize educational practice thus creating learning innovations that meet learners' needs. It is a common learning area which allows for the creation of a body of knowledge which expands and enhances national education revision [12]. In addition,

the Ministry of Education of Thailand has announced the further establishment of a pilot education innovation area in Kanchanaburi Province [13]. Important educational innovations have been made by 41 schools – significantly, they include the promotion of professional skills, and multi-study learning-management. These were aligned with the identity and strengths observed by a research team that visited the area to find local-wisdom related knowledge. Recent evidence demonstrates that the local-wisdom related knowledge management model can increase Economic Value Added (EVA). Historical stories delivered by a local philosopher are used as a tool to improve consumer knowledge [14]. In particular, focusing on a specific area is regarded as an important source for local-wisdom and community-based creative development, that eventually leads to long-term local sustainability through collaboration among local stakeholders and communities [15]. The team has also found that in Kanchanaburi Province, innovation of local-wisdom had many facets: for instance, belief in and respect for their ancestors' way of life; dressing in tribal clothing; eating a regional diet; and participating in unique folk plays during festivals. In addition, this particular province is an economic zone which is rich in beautiful and diverse touristic resources, ancient sites, and both historically and culturally valuable natural attractions. In accordance, we originated two research questions, which were:

1. What are the components and how does the local-wisdom learning-management model with digital resources serve students in the educational innovation area?
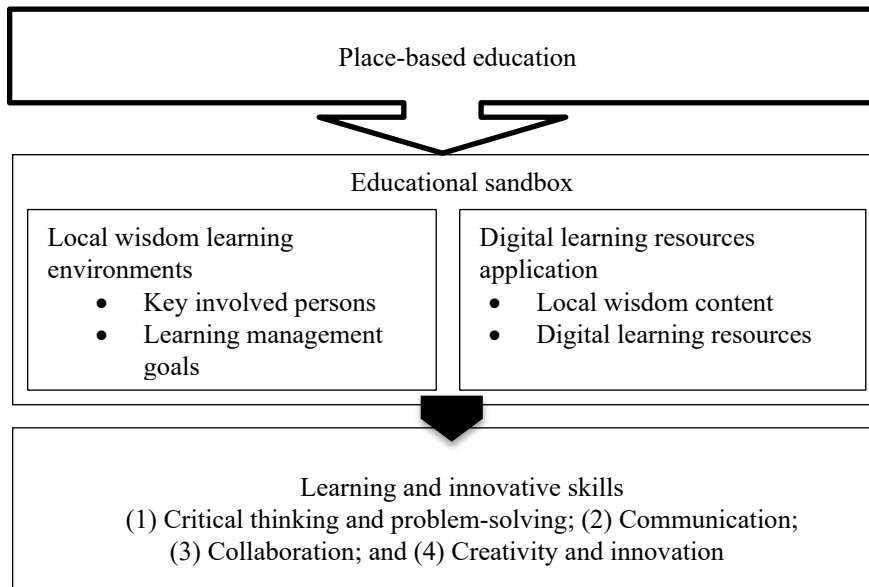2. To what extent do the students achieve learning and innovative skills after implementing the model?

Fig. 1. The research theoretical framework

2 Literature review

2.1 Place-based education

Place-based education can depend upon dynamic learning within the particular characteristics of a community's context [16]. Place-based education aims to make learning more relevant within the contexts of peoples' daily lives. Place-based education also involves peoples' participation in a variety of physical and social activities, drawing on community-oriented and real-world learning experiences [17]. The place-based educational program involved teachers, students, schools, and communities, incorporating local places, resources, and service-learning in the curriculum [18]. Emphasizing the resources, cultural characteristics of both regions and localities can be infused with value in economic culture [19]. Place-based education has been defined as the development of values and perspectives, along with understanding about the surrounding environment, as well as the culture [20]. While technology can be used to capture and annotate artifacts from a place, it can also be used to make thought 'visible'. Also, to expand on observations to see the discipline-related elements of a place that encourage reflection on new knowledge [21]. For example, the use of place-based education within virtual environment applications during the administration of an ecology class [22]. This study proposes local-wisdom learning environments which are more focused on historical and cultural perspectives.

2.2 Local wisdom learning environments

Local-wisdom might be driven by strengthening communities holistically, establishing local capacity for problem-solving, and building links between communities and source institutions in order to recognize the values inherent in resident and community assets [23]. Deep ties between wisdom and the local environment, humanity and its ecosystem, has produced unique local knowledge. 'Wisdom' is defined as knowledge gained through community recognition, and it is a trait said to belong to certain people who have added aspects of "khwaam ruu thaang sangkhom" to the Thai lexicon. To augment local knowledge in a beneficial way, the new application's results can be shown to a group and then further enhanced through the efforts of the collective [24]. It encourages community members to engage in their research and use their local knowledge as heretofore untapped capital that can build self-reliance and lead to sustainable resource management [25]. When people in the community understand, discuss, and look for solutions to their problems, they may learn to improve management of feasible development solutions, and understand their own lives better. Deeply embedded knowledge within elders is vital for local-wisdom support communities [26]. Local-wisdom is always produced within the context of people's lives. It comprises intangible and visible tangible items which can be divided into two categories: (1) concepts, thoughts, and the processes of the abstract mind, and; (2) concrete, empirical, and 'visible' wisdom [27]. There has been an attempt to bring local-wisdom into the

learning context – for example, through the use of storytelling to understand reading within certain living conditions and amidst class overcrowding [28]. This literature has shown that applying local-wisdom to produce learning innovations is a crucial resource for learning.

2.3 Digital learning resources

A type of software that allows a user to perform a specific action on a desktop or notebook computer is called a 'desktop application'. In contrast, applications that run on a mobile device are called 'mobile applications. In the report by [29], mobile applications are designed to help us in our daily lives and to connect to the internet from which we can receive information from distant places. In particular, teachers use digital learning platforms with a collection of learning resources in order to deliver learning experiences as part of their instruction [30]. In designing the learning resources, a user could interact with a collection of learning tools to gain access to personal learning resources, which include the ability to record and annotate learning events, manage learning materials, and collaborate with other students and teachers [31]. The role of stakeholders needs to be identified in the digital environment since previous studies have demonstrated that the interactions between a "teacher's digital tool" and a "student's digital tool" have been successfully implemented [32]. Additionally, we can explore the cultural and local environment using collaborative and communicative technologies with the aid of visuals, unique contents, and associated learning materials (text, photographs, video, questions, quizzes, external references) [33].

2.4 Learning and innovative skills

Learning and Innovative Skills (4Cs) are defined as the proficiency or ability to practice the principles of learning. Students' 21st Century learning skills in consist of (1) critical thinking and problem solving, (2) communication, (3) collaboration, and (4) creativity and innovation; and are essential for preparing students for the future [34]. For student learners, the 4C model influences their learning outcomes within the cognitive, psychomotor, and affective domains [35]. As far as teachers were concerned, [36] found that they possessed willingness to use the technology during their lessons. Mobile learning technologies in primary education can help improve students' thinking skills. Currently, mobile applications for smartphones and tablets with features and resources available to users at any time via an internet connection have come into play. These devices can be used for knowledge acquisition, knowledge sharing, knowledge application, and knowledge protection – all of which impact a general acceptance of mobile learning [37]. Given these digital resources, the researchers were interested in developing a learning-management model for local-wisdom. Research results would help students learn applying digital resource applications to build up their own innovative skills. That is, they can do this by expanding their learning achievements through local-wisdom, innovative learning skills, and then by disseminating their local-wisdom-based self-created works and materials. In addition, these research results will be well-established and designed based on scientifically sound principles [38].

3   Methodology

To begin this research, the research and development (R&D) method was used to examine preliminary data. According to the theoretical framework, there were two parts. The first part was the analysis of local-wisdom learning environments with the key information providers. The second part was the development of digital learning resources application and experimenting with students from pilot schools.

3.1   Participants

The study's participants included key information providers from the sandbox area, experts, village philosophers, and students from two elementary schools and two secondary schools in Kanchanaburi Province, Thailand's educational sandbox. On study completion there were 146 key information providers from the sandbox area including 73 school administrators and teachers from pilot schools, and 73 educational supervisors. Furthermore, nine experts and philosophers from various fields participated in the focus group. Finally, the learning model and application testing experiment involved 340 students from the four pilot schools, which consisted of two elementary and two secondary schools. An additional 154 students – divided into 25 separate groups – volunteered to participate in a group project and were evaluated by qualified teachers using a learning and innovative skills assessment form.

3.2   Instruments

Throughout the investigation, five primary instruments were developed and used. The opinion and guidelines survey and the model's efficacy evaluation form were used in the design and development process. The local-wisdom learning achievement test, the learning and innovation skills evaluation form, and the dissemination assessment form, were the other three instruments used for the experiment.

Opinion and guidelines survey. local-wisdom and technology use in innovation learning for educational sandbox pilot schools. There was a checklist and short answers related to demographics, ranking, and open-ended questions of the local-wisdom investigation. The sample questions were designed to specify useful local-wisdom in the educational sandbox, the learning resources related to local-wisdom, and the ICT learning equipment supporting teaching and learning. Five subject matter specialists were chosen to validate the survey questions. The model's efficacy evaluation form was comprised of the four components of the local-wisdom learning-management model in the digital learning resources application, the five-step learning process, and three possible assessments, according to subject matter experts. The evaluation was conducted in conjunction with, and according to, the directives included in the provided guideline handbook.

Local-wisdom learning achievement test. is used to measure the learning of local-wisdom. The goal of the 20-item multiple-choice test was to determine the pre- and post-results of a learning-management model that causes learners to change their behavior and increases their knowledge and understanding of local-wisdom.

Learning and innovation skills assessment form. an authentic assessment led by a teacher was used to assess students' skills after participating in group activities with digital learning resources application. Upon the review of concepts and theories related to innovative learning skills, the three skills listed as 21st Century skills are critical thinking and problem solving (effective reasoning, systematic thinking, problem- solving), communication and collaboration (clear communication, communal collaboration), and creativity and innovation (creative thinking). The form's designated 20 items were gauged via a 5-point Likert scale (ranging from 1-5 indicating low to high ability and behavior most commonly assessed). The questions included eight critical thinking and problem-solving items, five communication and collaboration items, and seven items assessing creativity and innovation. Sample questions were included at the head of each category. Their aims were to discern the reasons for choosing local-wisdom exploratory topics, encourage participation in presenting information on local-wisdom, and to present new techniques for use in the design of local intellectual works, respectively.

Dissemination of local-wisdom. there were 10 items, assessed by 3-levels of a scoring rubric incorporating four assessment criteria. They were as follows: learning, searching, choosing, and analysis of local-wisdom; creativity; the transfer of results including presentation techniques; product design; and information dissemination and application. The teacher led the evaluation process as a group project. All of the instrument items listed above were validated using 'item objective congruence' (IOC), which were applied by five experts. It was found that consistency values were above 0.95, which are considered suitable for use.

3.3   Procedures and data analysis

Analysis of local-wisdom learning environments. First, opinion polls were used to identify local-wisdom and technology highlights as used in the educational sandbox pilot schools. Researchers sent out a poster with quick response (QR) codes that were linked to opinion polls previously distributed to pilot school teachers and other educational personnel. Content analysis was performed on the collected data.

Second, 'participatory action research' (PAR) was integrated into the focus group discussions so participants could exchange ideas, identify resources, and investigate the learning area. Within the study, nine experts from various fields in Kanchanaburi province participated in the focus group. They included: village philosophers, community leaders who had knowledge and abilities associated with local-wisdom, and local network partners who supported the pilot school activities. The goal of the focus group, for example, at Ban Mae Khun Thai Methodology Learning Center (Nong Khao Subdistrict, Tha Muang District) was to share suggestions for developing a digital learning resource. In this stage, 'typological analysis' was applied in order to gain further insight. Consequently, the research team traveled to the appropriate locations to collect audio, photos, and videos, as well as to accumulate knowledge of local-wisdom from village philosophers and local people who are best acquainted with it. The following areas were explored: arts, agriculture, handicrafts, local nutrition, traditional belief and respect, natural resources management, and the environment. Local-wisdom resources

were collected and analyzed using 'manifest content' and 'descriptive- analytic induction'.

The development of digital learning resources application. After that, a learning-management model was developed and verified by five subject matter specialists. An application for digital learning resources called 'local- wisdom in Kanchanaburi City' was created to be used by learners in educational sandbox pilot schools. The model and application were then put to the test with students from elementary and secondary schools. Students were asked to take the local-wisdom learning achievement test before the trial. Then, when using the application, students were given a post-test. Finally, some of the students voluntarily participated in a group project which involved creating their own resources (including creative videos and posters). Each individual's learning and innovative skills were evaluated by their teacher, who had received the guideline manual and substantial training from the researcher with the learning and innovation skills assessment form. Five experts evaluated the final group output using 'inter-rater reliability'(IRR). All final data were analyzed for mean (M), standard deviation (SD), and dependent sample t-tests.

4 Results

These results of the study generated the local-wisdom learning-management model which combined real-life settings with pedagogical processes. Other educators and stakeholders involved in designing place-based education in various locations may find emulating this approach to be fruitful.

4.1 Proposed local wisdom learning management model

Results of the design and development revealed the top five issues within local-wisdom that should be managed for students with the aid of digital learning applications. They include wisdom about agriculture (N=39), handicrafts (N=36), tourism (N=21), Thai traditional medicine (N=26), and rituals (N=24). The developed learning-management model's effectiveness was based on subject-matter specialists' evaluations: five experts judged whether the objectives were achieved and rated them according to the scale. Analysis of the assessment results found the model's overall efficiency to be very high (M = 4.92, SD = 0.28). Evaluation results of the digital application for local-wisdom found all aspects at high levels (M = 4.95, SD = 0.21) including usage (M = 4.98, SD = 0.16), application design (M = 4.98, SD =0.16), and learning activity (M =4.91, SD = 0.29). Furthermore, the application manual's quality assessment showed that, overall, its level was very high (M = 4.88, SD = 0.33). The manual's content is arranged in an easy-to-understand step-by-step order. Content was presented following use of the application use. Overall satisfaction with the manual's benefits was 'perfect' (M = 5.00, SD = 0.00).

In the educational sandbox area, development of a local-wisdom learning- management model consisted of: 1) four components of local knowledge learning- management with the digital learning resource application; 2) five steps of local knowledge

learning-management with the digital learning resource application; and 3) three evaluation methods of local-knowledge learning-management with the digital learning resources application, as shown in Figure 2. The details of each finding are given in the discussion section.
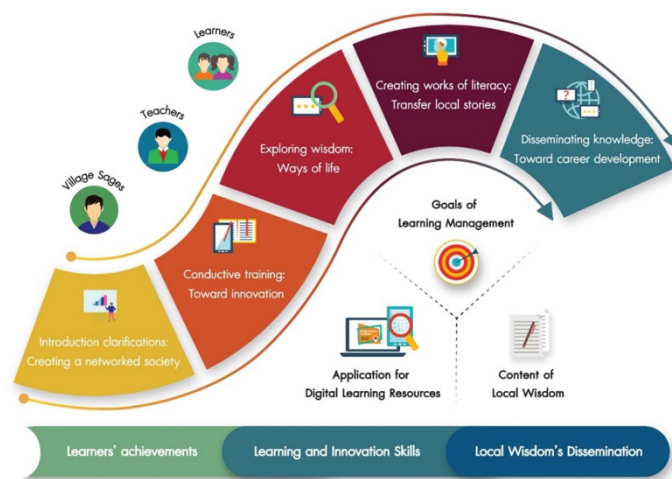

Fig. 2. The local-wisdom learning-management model with digital resources application for learners in the educational innovation area

4.2 Students' achievement and learning and innovative skills

The pre- and post-test results of the local-wisdom learning achievement model (Table 1) revealed that there was a significant difference (p = .00) between the pre-test (M = 5.04, SD = 4.07) and post-test (M = 12.72, SD = 7.11) scores. This study brought to light evidence that after implementing the model with the digital learning resources application, learners' achievement levels in local-wisdom from the four pilot schools (two elementary and two secondary schools) were higher than before the experiment.

T-test results comparing pre-and post-test of local wisdom learning achievement

Scores	N	M	SD	t	sf	p
Pre-test	340	5.04	4.07	-62.11	339	.00**
Post-test	340	12.72	7.11			

*p < 0.01

In addition, we asked teachers from the two primary schools and two secondary schools to evaluate students' learning and innovation skills (N = 154) after the experiment was done and local-wisdom had been disseminated during the group project. The results confirmed high to highest levels of learning and innovation skills were reflected within the three main categories: critical thinking and problem solving (CTPS), communication and collaboration (CC), creativity and innovation (CI) listed under the 21st-

century skills. From (Table 2), the overall primary students' learning and innovation skills were high (M = 4.24, SD = .65). When taking the different schools into consideration, both also received high levels (M = 4.37, 3.92, SD = .61, .65), respectively. The data indicated a high level of all sub-skills, except CC and CI in the first school, received the highest level. Results from secondary schools indicated the highest level of learning and innovation (M = 4.55, SD = .52). Both secondary schools received high levels (M = 4.53, 4.59, SD = .53, .50). We found similarly high levels for CC and CI skills, while CTPS received a high level of scores. Finally, the teacher's evaluation of the dissemination of local-wisdom of 25 groups works (N=154). The groups gathered based on ten assessment criteria (full score of 30 points) revealed that it is at a good level overall. The overall average score was 22.62 points, indicating 75.40 percent represented a minimum of good quality.

Table 2. Analysis of mean, standard deviation, and interpretation of skills

Skills	X	S.D.	Interpre-tation	X	S.D.	Interpre-tation	X	S.D.	Interpre-tation
Elementary School	1st (N=55)			2nd (N=21)			Total		
CTPS	4.10	0.65	High	3.85	0.66	High	4.03	0.66	High
CC	4.54	0.55	Highest	4.07	0.61	High	4.41	0.60	High
CI	4.50	9.52	Highest	3.85	0.67	High	4.32	0.63	High
Overall Skills	4.37	0.61	High	3.92	0.65	High	4.24	0.65	High
Secondary Schools	3rd (N=53)			4th (N=25)			Total		
CTPS	4.40	0.55	High	4.46	0.52	High	4.42	0.54	High
CC	4.59	0.49	Highest	4.64	0.48	Highest	4.60	0.49	Highest
CI	4.61	0.51	Highest	4.66	0.47	Highest	4.62	0.50	Highest
Overall Skills	4.53	0.53	Highest	4.59	0.50	Highest	4.55	0.52	Highest

*Interpretation criteria: 4.50 – 5.00 = highest level, 3.50 – 4.49 = high level, 2.50 – 3.49 = moderate level, 1.50 – 2.49 = low level, 1.00-1.49 = lowest level.

5 Discussions

This study set out to design a local-wisdom learning model and develop a digital learning resources application to enhance K-12 students' learning and innovation in the educational sandbox. This section highlights the features of each component, instructional approach, and evaluation as we elaborate on each finding. The value of the local-wisdom learning-management model consists of the four components, five processes, and three evaluation methods of local knowledge learning-management with digital learning resources application. Based on the findings, subsequent discussions will focus on developing educational sandbox innovations, mainly how to use the local environment to lead to digital teaching and learning to improve educational achievement in learning and innovation.

5.1 The four components of developed model are as follows

Key involved persons, learning goals, content, and a digital learning resource application are the four components of local-wisdom learning-management with digital learning resources application (Figure 3). The details of each component are as follows:

Component 1: Key involved persons. 1) A village philosopher who has the knowledge, ability, and expertise to provide information and suggest valuable resources such as information about the community's way of life. The student team selects a village philosopher who possesses knowledge of the group's topic of interest, as well as a parent or acquaintance in the community. Student teams gather primary-source information and search online resources for information applicable to benefit, extend, or help adapt to a changing society. Students who visit the sage and/or the area, for instance, request interviews, take notes, and/or shoot video clips. 2) As team mentors, teachers help develop students' learning and innovative skills and help them choose, receive, seek, and apply useful local-wisdom to be inculcated into work products. These teachers suggest field visits in order to collect data, monitor, and stimulate ideas, provide advice, and suggest solutions to problems that might arise for the students. 3) Becoming skilled in communications, learners can access the application anytime, anywhere. They can search for and find additional information to aid development of learning and innovation skills. Participating in these activities builds students' confidence in the idea that learning happens in the classroom and that activities outside the classroom are important.

Component 2: Goals of learning-management are: 1) to develop teachers' knowledge, expertise, and skills in applying ICT to local-wisdom learning- management; 2) to develop learners' knowledge, understanding, and consciousness of preserving valuable wisdom and understanding of local ways of living; 3) to collect, record and transmit local-wisdom related stories; 4) to develop learning achievements of local-wisdom innovation learning skills, and evaluate learners' dissemination of local-wisdom.

Component 3: The content of outstanding local-wisdom may seem like an invention in that techniques, methods, or a body of knowledge arising from place-based competence and accumulated experience might have to be carefully conceptualized. Content likely emerges from the ingenuity of villagers or local people through their long-time learning process, which involves choosing successful solutions, and developing them in accordance with the eras which they inhabit. It is likely that inherited wisdom can be applied combined with knowledge and experience to improve their current quality of life and to solve problems that arise from lifestyle choices. Content passed from ancestors down to the present generation includes wisdom on folk nutrition, agriculture, handicrafts, beliefs, traditions, and folk performance arts.

Component 4: Digital learning resources application in this case, local-wisdom resources have been developed for use on mobile devices in order to transfer local-wisdom to learners. The application has also become a dynamic source of information for students' work productions. Teachers will use it as instructional media to help convey content clearly and make it easier for future learners to understand complex content. It can also help stimulate interest, make learning fun, and help students quickly review

their knowledge. In addition, the changing Covid-19 situation has resulted in inevitable changes to learning-management; for one thing, it has made it difficult to invite experts to broadcast directly. Therefore, knowledge collected from village philosophers and local people and combined into learning resources makes teaching and learning activities more convenient.
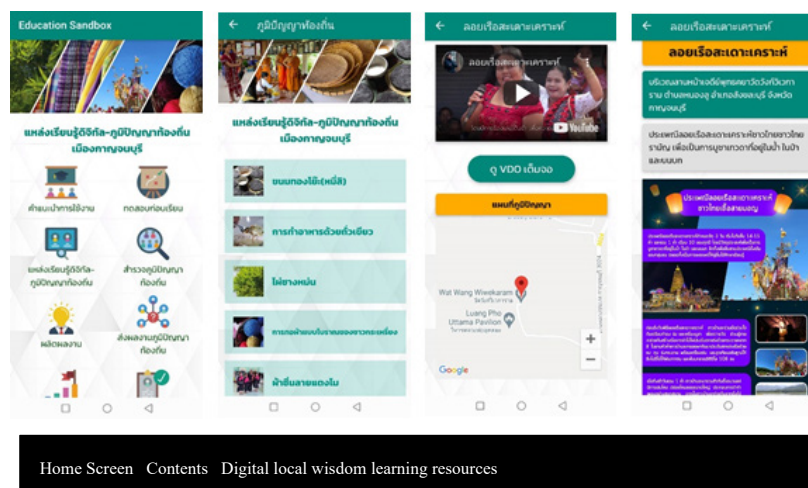

Fig. 3. Application for digital learning resources—local wisdom

This model is based on a theoretical framework in which key involved persons and goals of learning-management are included in local-wisdom learning environments. Meanwhile, local-wisdom content in a digital format is important for the digital learning resources application. All of the digital learning resource application components are supported by the 'innovation ecosystem' principle, in which participants must follow the ecosystem strategies, including strategic management, value creation, and business models in tandem with their partners [39]. The integration of a strong local private sector aims to enhance livelihoods in developing countries in terms of educational value. An informal setting can lead to creative learning and problem-solving [40]. The elements presented are also built under the influence of place-based education. Mobile media's place-based digital memory not only functions as a system for remembering and recognizing history through recording but also is used as a tool for creating lasting experiences [41]. It also valued the development of knowledge and experiences with stronger ties to the community, increasing their awareness of the natural world and their commitment to acting as active, contributing citizens [42]. The place-based approach also bridges entrepreneurial education with place-based and place-conscious learning [43], contributing to socioeconomic transformation with place-specific, culture-related, social, and ethical themes [44]. These findings support a recent study in Thailand that found that utilizing place-based local culture within communities promotes creative learning innovation aiding in the development of future global citizens [45].

In terms of the study's outcomes, it was revealed that developing a local-wisdom learning-management model supports promoting students' achievements, learning, and

innovation skills. With an evidence-based assessment, it can be used as a tool to support personalized learning -- or it can be used for accountability purposes [46]. This study produced results which corroborate many previous findings, such as: the use of learning self-management [47]; the integration of local-wisdom values in order to solve problems [48]; or the use of video learning based on local-wisdom to promote learning achievements [49]; or the use of local-wisdom modules to foster critical thinking [50]. Moreover, it can also develop a sense of belonging for those involved with place-based learning [51] in the form of the local community of inquiry [52]. For example, students have a chance to share empathic dissonance towards others, and increase compassion for those people having such experiences [53]. The findings also suggest the feasibility of using the learning-management model for the learning process – a finding which corresponds to [54]'s work that uses a module derived from local-wisdom. As pertains to the discussion above, we suggest five steps for the learning-management process to follow in order to help teachers design teaching and learning procedures.

5.2 The five steps of the learning-management process

The five steps of the learning-management process are: introduction clarifications, conductive training, wisdom exploration, creation of literate works, and knowledge dissemination. The rationale for each stage is explained in the section below.

Step 1 introduction clarifications: Creating a networked society. The first step is to prepare teachers so they can raise awareness and indicate the value of participating in the guideline's activities -- including employing Thai wisdom during informal learning outside the school system. Our research suggests that educational agencies should mobilize the community's human resources to participate in their own educational management. By incorporating local people's experience, knowledge, expertise, and local-wisdom into informal learning, and having a strong, cooperative coordinator in each school, the school community can efficiently build a cooperative network. From there on in, social media can track various activities and be an effective channel for exchanging information.

Step 2 conductive training: Toward innovation. Training workshops should be held for teachers' introduction to the use of ICT for access to teaching material resources, design, and development. Before teachers use the application to manage course learning, they should create a portfolio using infographic design applications such as Canva, Piktochart, VivaVideo, and KineMaster clip editor. However, after discussions along with laboratory face-to-face and Zoom training, a survey of teaching-learning conditions revealed that only 35.61% of teachers have a high enough level of knowledge and skills to use applications to manage instruction. Thus, preparation of teachers is very necessary before applying ICT in creative integrated teaching and learning-management. Teacher preparation would reduce duplication of course content and the time spent learning content.

Step 3 exploring wisdom: Ways of life. In this step, students begin to participate by registering to use the application. They are then divided into groups to brainstorm ideas, and to make plans to visit an area and explore. Learning from community resources enhances students' abilities to seek knowledge, be curious, and know how to

ask questions which elicit the appropriate answers. They should practice interviewing people known to the interviewer, enabling them to collect information, take notes and shoot video clips. These activities further enable learners to acquire independent knowledge-seeking skills, and to align with educational standards, which suggests that teaching and learning-management should be adjusted primarily according to learners' needs. Emphasis should be placed on integrating knowledge and taking proactive action to train students in the processes of being creative and innovative, to prepare them for the world of work.

Step 4 creating works of literacy: Transference of local stories. During this step students help analyze information obtained from field visits to the community. Students so far have had direct experience, and fun, as learners, commenting in the past with statements like "I would like to have a project or activity that allows me to go out to learn because I have gained knowledge and new experiences". In fact, many students not local to Kanchanaburi gain more knowledge about the province, and elementary students unfamiliar with the group can present issues they want to explore. However, younger students likely require more teacher guidance than high school students. When working in a team with a group of friends, they might need help in the practice of being assertive. However, students can learn how to solve problems they encounter and apply knowledge gained in designing infographics and video clips.

Step 5 disseminating knowledge: Progressing toward career development. At this step, students' creative works are published for interested people to study and to be able to appreciate the wisdom of their local way of life. Evaluation of students' work has already demonstrated that they can present interesting stories through a sequence of steps or demonstration activities which convey their strong knowledge of a particular subject. Furthermore, the dissemination of local-wisdom forms a valuable body of knowledge for learners as well as an option for further developing life-skills. Besides that, the process encourages students to build skills and pursue future sustainable careers according to their aptitudes.

5.3 Three evaluation methods of local wisdom learning management with the digital learning resources application

The local-wisdom learning-management was assessed in three following ways: learning achievement, learning and innovation skills, and dissemination of local- wisdom. The evaluation criteria could be generated from the research instruments that have been validated in this study.

Local-wisdom learning achievement refers to learning-management processes that cause learners to change their behavior in three areas: Knowledge can be gained by participating in activities to practice learning and innovative skills; management of local-knowledge learning with digital skills will have been learned; and students will have acted creatively with the aid of the application. Overall, their attitudes affect their actions, which express awareness and motivation toward acquiring local-wisdom. A multiple-choice test may be administered before and after learners participate in the application's activities, in order to measure individual and group learning achievement in local-wisdom.

Learning and innovation skills (the 4Cs) refers to the proficiency or ability to act or implement the learning principles of three 21st-century living skills: 1) critical thinking and problem-solving; 2) communication; 3) collaboration, and; 4) creativity and innovation. The assessment is based on actual conditions, and teachers may conduct an assessment after students participate in the application's local-wisdom learning-management activities.

The dissemination of local-wisdom refers to expressions or actions arising from learning and practice until the ability to use communication channels to pass local-wisdom to other groups has been properly developed. Dissemination may take the form of text, images, audio, and/or multimedia. It may be on paper or through electronic media, and will encourage sharing and the helping of others to learn their own local-wisdom. The dissemination of local-wisdom is evaluated using the following four assessment criteria: 1) learning, searching, selection, and analysis; 2) creativity, and transfer of works; 3) presentation techniques, and design of works and 4) dissemination of information and its application. The assessments suggest using a rubric-based system to score success in completing tasks.

In order to establish the value of the research to the academician and the practitioner, technology was used to connect the body of knowledge in a place-specific context with the pedagogical processes referred to as 'place-based education'. Students can be active members of the community and even at the same time be the innovators themselves. This is in line with [55], who stated that the value of place-based education increases through heritage attachment, place attachment, place-making, and place-branding. Digital resources such as stories composed of photos and sounds extracted from their everyday environments, can be a potential tool -- not only for introspection and self-reflection, but also as a process in which individual stories can be explored as they unfold within broader geopolitical contexts [56]. Lastly, this research supports the place-based education curricula which generate better learning achievements and further impact such skills as learning and innovation and the dissemination of local-wisdom. This pedagogy encourages them to participate in their communities and gain a deeper understanding of their local social and biophysical ecosystems [57].

6 Practical implications

This research extends our knowledge of implementing the model of place-based education through the local-wisdom learning environments with a digital learning resources application. Using the place-based education approach, this study provided success criteria and instructions for actualizing a model of local-wisdom learning- management via a mobile application with digital learning resources -- as well as practical consequences and recommendations for a wide range of stakeholders. Advances in information and communication technology have transformed human learning patterns. Specifically, in the form of communication tools such as smartphones and tablets which since they are connected to the Internet help access information. Furthermore, information useful for peoples lifelong learning has relatively greater potential, especially in mobile application software that teachers can use as a medium to transmit the content

of various courses and help students learn more easily. Therefore, guidelines are needed for preparing curricular infrastructures that provide digital equipment and help with internet costs in order to ameliorate learning via mobile applications that learners, teachers, and parents can access anytime and anywhere.

Developing a student's three learning and innovation skills for living in the 21st century is crucial. Students must be prepared for self-development and self-direction to succeed in both future work and life. Students who go outside the classroom to encounter various learning situations learn discretion in decision-making. Additionally, by working as cooperative teams in the absorption of local-wisdom, students can function well, share responsibility, find solutions and come up with new perspectives when encountering obstacles. They can also learn how to be open to other opinions, and to innovate, and to initiate creative endeavors.

Integrating technology into education and new educational innovations allows students to learn independently. Designing various learning activities appropriate for learners' ages and needs enables them to learn according to their interests and might improve analyses of individual students' varied learning styles. This can enable improved policy formulation and appropriate development of the teaching and learning system without waste, and improve focus on using technology to help students learn actively by using it to facilitate interaction in learning.

In conveying the content of local-wisdom to learners, teachers must recognize the cognition value of local-wisdom and lifestyles and offer relevant experience in order to be able to provide advice and facilitate the preparation of learners in their exploration of interesting local resources. Teachers must therefore practice their skills in data storage, learn to manage local-wisdom knowledge pedagogically, and learn to evaluate students' work, whether it be in the form of infographics, or video clips that convey stories of local-wisdom that learners jointly design and create. Students' work products are disseminated to those in the educational innovation area interested in learning useful local-wisdom. Students' products can also be used to extend the body of knowledge to life skills and occupations and, in the future, to learners throughout Thailand.

Mechanisms of co-education management to be used among researchers, teachers, experts, village philosophers, and community leaders – all of whom may possess knowledge and abilities related to local-wisdom – and their network partners are essential. They can support pilot schools' activities if all stakeholders accept, trust, and have a sense of responsibility for them. They would see community participation as necessary for managing learning resources. Thus, they would attempt to develop a local-wisdom learning community to identify the appropriate body of knowledge to pass on to their children and youths and to instill in them pride in their community. The young people of a particular area become more conscientious about preserving valuable local wisdom, and of the significance of understanding their own local lifestyle. Therefore, we urge stakeholders to acknowledge, to plan, to express views, to exchange information and opinions, to seek knowledge, and to collect the experiences accumulated by individuals and other learning resources through a community's long wisdom-gathering process assimilating place-based model and pedagogical procedures. All stakeholders can cooperate in a friendly discussion forum and digitally collect learning resources

that can be distributed without limitation to an ever-changing global society. In this way, the community will be solid and sustainable in the future.

7   Conclusion and recommendations

The key results in this study concern bringing place-based education into practice with a proposed model and the learning-management process and to submit it to evaluations. This study demonstrated how the local-wisdom learning environments and digital learning resources application can be used for the increase of learning achievements, and innovation skills. The findings contribute to expanding the theoretical contribution to the field on the topic of culture-learning in local-wisdom through digital environments. This finding also offers some important notes with recommendations. First, students may learn while using mobile devices such as smartphones, tablets and internet networks to access the content. They use them to record and store data and produce results, so digital devices must be available and prepared. Computer equipment and internet expenses necessary for enabling learners to perform activities using mobile applications conveniently must be made accessible. Second, workshops should be conducted in which teachers are encouraged to gain knowledge and ability related to the design of learning activities. It is important to promote learning experiences which are pertinent and appropriate to the current situation. Teachers should be made aware of the modern techniques of using information and communication technologies. A variety of digital tools can be used to enable the implementation of local-wisdom learning-management models with a digital resources application to extend the body of knowledge and apply it to further expand the transfer of results to learners. Most importantly, students need to develop essential life skills in this 21st-century world, especially learning and innovative skills, information, media, and technological skills. Education administrators should mention policies or procedures and factors that promote the integration of knowledge when teaching core subjects that can be combined with it. Specialized vocational and learning skills will enable learners to succeed in living a life that keeps pace with a changing digital world. This work contributes to existing knowledge which sustains the smart product innovation ecosystem issues in co-innovation that match their capabilities and resources [58]. This research has thrown up many questions in need of further investigation concerning certain advancements in technology, e.g. immersive virtual field trips for an evidence-based foundation [59], context awareness game-based learning [60], and the integration of local-wisdom forms in augmented reality (AR) applications [3]. The conclusions in this paper are limited by the fact that the educational sandbox which permits educators to experiment without restrictions placed on policy is the basis for the generalizability of the results. In addition, we suggest an in-depth study of the critical factors in promoting and supporting the creation of a professional learning national and global community that facilitates the integration of teaching and learning into diverse subjects. As well, further studies of cooperation and channels for exchanging relevant knowledge between teachers is needed.

The body of knowledge on local-wisdom can be considered a way of thinking or even a way of life since it consists of practices that have been passed down from ancestors to later generations. Therefore, the collection of knowledge to be stored in digital learning resources is an important aspect that should be developed, keeping in mind that that the origin must be reliable and accurate when identifying reference sources in order to be able to disseminate local-wisdom to the youth in such a way that they can accept and use it effectively.

8   Acknowledgment

9   References

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