COMMUNITY-BASED EXPERIENTIAL LEARNING IN REMOTE SENSING: IMPACTS ON SPATIAL COMPETENCY AND PROFESSIONAL SKILL DEVELOPMENT

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Abstract

This study aimed to evaluate the effects of community-based experiential learning in remote sensing on the development of spatial competency and professional skills among undergraduate students, using coconut plantation areas in Samut Songkhram Province as the learning context. The study employed evaluation research design. The sample consisted of 50 students who participated in field-based learning activities, including the integration of satellite imagery with ground-based data and collaborative learning with local communities. Research instruments included a Likert-scale questionnaire, a performance-based competency assessment, pre- and post-learning competency assessments, self-assessment and satisfaction questionnaires, and an end-of-course survey. Data were analyzed using descriptive statistics, including mean, standard deviation, and percentage. The results indicated that students demonstrated high to very high levels of experiential learning, satisfaction, and community engagement. Spatial competency improved from a moderate level prior to the learning activities to a good level after participation. In addition, students exhibited good levels of remote sensing skills and professional skills, particularly teamwork, problem-solving, and communication with community stakeholders. The findings suggest that integrating experiential learning, community-based learning, and remote sensing within an agricultural context effectively supports the development of students' spatial competency and professional skills.

Keywords: Community-Based Learning, Remote Sensing, Spatial Competency

Introduction

In the context of rapid advancements in geospatial information technologies, remote sensing has become a critical tool for understanding the dynamics of natural resources, agricultural systems, and spatial environments. This is particularly evident in agricultural areas with distinct geo-ecological and socio-cultural characteristics, such as coconut plantation areas in Samut Songkhram Province, where complex interactions exist among land use, water systems, community livelihoods, and local economies. However, higher education instruction in remote sensing has traditionally emphasized theoretical knowledge and laboratory-based practices, which often limits students' opportunities to connect spatial knowledge with real-world contexts and the social dimensions of the study area.

Experiential learning and community-based learning have been widely recognized as effective approaches for fostering deep learning by engaging students with real-world problems and contextual settings through hands-on practice, reflection, and collaborative learning with local stakeholders. When these approaches are integrated into remote sensing education, they enable students not only to understand the technical principles of satellite image interpretation and spatial data analysis, but also to develop systems thinking and spatial thinking aligned with the realities of local communities.

Spatial competency is a core competency for students in geospatial and remote sensing disciplines. It encompasses the ability to perceive spatial relationships, interpret visual and cartographic data, analyze spatial patterns, and communicate spatial information effectively. Moreover, learning in real-world contexts facilitates the development of essential professional skills, including teamwork, community communication, situational problem-solving, and social responsibility—skills that are increasingly valued in the geospatial workforce.

Samut Songkhram Province is a coastal agricultural area where coconut-based agroecosystems form the foundation of local economies and cultural identity. Utilizing this area as a learning base for experiential remote sensing education allows students to apply satellite and spatial data to understand crop structures, water management systems, and land-use patterns in real-world settings. At the same time, local communities benefit from knowledge exchange and evidence-based spatial information that can support area-based management and sustainable development.

Although previous studies have demonstrated the benefits of experiential and community-based learning for student learning outcomes, empirical evaluations of integrating remote sensing with community-based learning—particularly in agricultural, place-based context remain limited. Furthermore, much of the existing research relies on inferential statistics or qualitative assessments, with relatively little emphasis on descriptive statistical approaches to systematically capture changes in students' competencies and skills.

Therefore, this study aims to examine the effects of community-based experiential learning in remote sensing on the development of students' spatial competency and professional skills, using coconut plantation areas in Samut Songkhram Province as a case study. Descriptive statistics are employed as the primary analytical approach to assess learning outcomes, providing empirical insights that reflect the actual learning process and offering practical guidance for enhancing geospatial and remote sensing education in community-based and sustainable contexts.

Research Objectives

1. To evaluate students' levels of spatial competency before and after the implementation of community-based experiential learning (CBEL).

2. To assess the development of students' professional skills through remote sensing activities conducted in coconut plantation areas.

3. To examine students' satisfaction with the community-based experiential learning approach.

Scope of Research

This study focused on undergraduate students enrolled in courses related to geospatial studies and remote sensing. The scope of the variables included spatial competency, professional skills, and student satisfaction. The study was conducted over one academic semester and employed coconut plantation areas in Samut Songkhram Province as the learning context for implementing community-based experiential learning activities.

Literature Review

Experiential learning conceptualizes learning as a cyclical process of experience, reflection, conceptualization, and experimentation, enabling deep understanding and practical application (Kolb, 1984). This framework has been extended to community-based learning (CBL), which emphasizes engagement with real community contexts and meaningful learning experiences (Bringle & Hatcher, 1996). Although CBL has been shown to enhance motivation and contextual understanding, learning outcomes are often assessed qualitatively, limiting systematic quantitative comparison (Eyler, 2009).

Remote sensing and geospatial education require the integration of theoretical knowledge and applied skills. Instruction confined to laboratory settings alone may be insufficient for developing real-world spatial understanding (Unwin, Foote, & Tate, 2011). Learning in real environments allows students to better connect satellite imagery with physical and human landscapes (Baker et al., 2015), while field-based activities enhance ground-truthing and communication skills essential to geospatial practice (Sui & DeLyser, 2012).

Spatial competency—the ability to perceive, analyze, and communicate spatial relationships—is a fundamental outcome in geospatial education and develops most effectively through engagement with real data and environments (Uttal et al., 2013). In community-based learning contexts characterized by diverse activities, descriptive statistics provide an appropriate approach for capturing overall competency levels and development trends (Jo & Bednarz, 2009). In addition, professional skills such as teamwork, communication, and problem-solving are fostered through authentic participation in real-world tasks (Lave & Wenger, 1991), yet assessment remains largely qualitative; incorporating quantitative indicators can strengthen evaluation rigor (Boud & Falchikov, 2007).

Overall, the literature reveals limited integration of remote sensing education with community-based agricultural contexts, insufficient use of descriptive statistical evaluation, and a lack of place-based studies in specific agricultural settings such as coastal coconut plantations. This study addresses these gaps within the context of Samut Songkhram Province.

Research Methodology

This study employed an **evaluation research design** to assess the effects of community-based experiential learning (CBEL) in remote sensing on students' spatial competency, professional skills, and learning satisfaction.

The research was conducted in four stages: (1) planning CBEL learning activities, (2) implementing field-based learning, (3) collecting pre- and post-learning data, and (4) analyzing and summarizing the results. The learning activities integrated fieldwork, satellite imagery analysis, ground-truth data collection, and collaborative learning with agricultural communities in coconut plantation areas in Samut Songkhram Province.

Data was collected using a spatial competency assessment (five-point scale), a professional skills assessment, and a student satisfaction questionnaire. All instruments were developed in alignment with the conceptual framework derived from experiential learning, community-based learning, remote sensing education, spatial competency, and professional skill development.

Data analysis was conducted using **descriptive statistics**, including mean, standard deviation, and percentage. This analytical approach was considered appropriate for the evaluation research design and for capturing overall learning outcomes and development trends resulting from the CBEL implementation.

Table 1: Alignment of Literature Base, Learning Process, Indicators, and Measurement

Literature Base	Learning Process (Method)	Variables / Indicators	Measurement and Analysis
Experiential Learning Theory (Kolb, 1984)	Experiential learning activities through field-based practice and reflective learning	Level of experiential learning: practical understanding; reflective learning	Five-point Likert-scale questionnaire; mean and SD
Community-Based Learning (Bringle & Hatcher, 1996)	Collaborative learning with agricultural communities in coconut plantation areas, Samut Songkhram Province	Community engagement: community communication; collaboration with stakeholders	Self-assessment and observation; mean and percentage
Remote Sensing Education (Foote et al., 2011)	Field and laboratory activities integrating satellite imagery with ground-based data	Remote sensing skills: satellite image interpretation; ground truthing	Performance-based competency assessment; mean and SD
Spatial Competency	Spatial data analysis based on real-world contexts	Spatial competency: spatial thinking; spatial relationship analysis; spatial communication	Pre- and post-learning competency assessment; mean and standard deviation
Professional Skills Development (Wiek et al., 2011)	Teamwork and real-world problem-solving activities	Professional skills: teamwork; problem-solving; social responsibility	Self-assessment and satisfaction survey; mean and percentage
Learning Outcome Assessment (Boud & Falchikov, 2007)	Post-activity evaluation	Learning satisfaction and perceived learning value	End-of-course questionnaire; descriptive statistics

Research Results

The results are presented in six sections based on the measurement instruments and analytical procedures defined in the conceptual framework. The sample consisted of 50 undergraduate students who participated in community-based experiential learning in remote sensing within coconut plantation areas in Samut Songkhram Province.

Table 2: Experiential Learning Outcomes

Evaluation Item	Mean	S.D.	Level
Understanding from hands-on practice	4.42	0.51	Excellent
Reflective learning after activities	4.35	0.56	Excellent
Linking theory to real-world contexts	4.28	0.60	Excellent
Overall	**4.35**	**0.56**	**Excellent**

Students demonstrated a **very high level of experiential learning** (Mean = 4.35, S.D. = 0.56), indicating strong understanding derived from hands-on practice and reflective learning.

Table 3: Community Engagement Outcomes

Indicator	Mean	S.D.	Level
Communication with the community	4.30	0.59	Excellent
Collaboration with stakeholders	4.18	0.63	Good
Awareness of community context	4.34	0.57	Excellent
Overall	**4.27**	**0.60**	**Excellent**

Overall community engagement was rated at an excellent level, with particularly strong performance in community communication and awareness of community context. These results indicate the effectiveness of the community-based learning approach in fostering meaningful student engagement with local stakeholders.

Table 4: Remote Sensing Skill Outcomes

Skill	Mean	S.D.	Level
Satellite image interpretation	4.22	0.58	Excellent
Ground truth data verification	4.10	0.62	Good
Use of spatial data for analysis	4.18	0.55	Good
Overall	**4.17**	**0.58**	**Good**

Overall remote sensing skills were rated at a **good level** (Mean = 4.17, S.D. = 0.58), including satellite image interpretation and ground-truth data verification.

Table 5: Spatial Competency (Pre–Post Assessment)

Assessment Period	Mean	S.D.	Level
Before learning	3.52	0.64	Moderate
After learning	4.26	0.57	Excellent
Change	**+0.74**	–	Improved

Spatial competency increased from a **moderate level before learning** (Mean = 3.52, SD = 0.64) to a **good level after learning** (Mean = 4.26, S.D. = 0.57), indicating a clear positive learning trend.

Table 6: Professional Skills and Learning Satisfaction

Evaluation Item	Mean	S.D.	Level
Teamwork	4.40	0.54	Excellent
Situational problem-solving	4.25	0.61	Excellent
Social responsibility	4.46	0.52	Excellent
Overall learning satisfaction	4.48	0.50	Excellent
Overall	**4.40**	**0.55**	**Excellent**

Professional skills were rated at an excellent level, particularly in teamwork and social responsibility. Overall learning satisfaction was also rated as excellent, indicating positive student perceptions of the learning experience.

Discussion

The findings of this study indicate that community-based experiential learning (CBEL) in remote sensing can effectively enhance students' spatial competency and professional skills when real-world agricultural contexts, such as coconut plantation areas in Samut Songkhram Province, are integrated into the learning process. These results are consistent with Kolb's experiential learning theory (1984), which conceptualizes learning as the integration of concrete experience and reflective practice, enabling students to meaningfully connect theoretical knowledge with practical application. (Ngansakul, Poorahong, Suridechakul, & Chetanont, 2023) Satellite imagery, field surveys provide more accurate results. The results can be used to refer to the trend of changes in the use of urban areas and buildings in the area as a guide for studying urban expansion support and effective management

The high levels of experiential learning and student satisfaction observed in this study support the principles of community-based learning proposed by Bringle and Hatcher (1996) and align with Eyler (2009), who emphasized that learning in authentic contexts enhances contextual understanding and learning motivation. Engagement with agricultural communities also enabled students to develop communication and collaboration skills through interaction with multiple stakeholders, reflecting social learning processes and shared knowledge construction.

Improvements in remote sensing skills and spatial competency after participation in CBEL activities are consistent with spatial education frameworks that emphasize interaction with real data and real-world environments. The findings support Unwin et al. (2011), who reported that integrating field-based activities with geospatial education improves students' understanding of the relationship between satellite imagery and actual landscape conditions, particularly through ground-truthing practices essential to professional remote sensing work.

The observed increase in spatial competency from a moderate level before learning to a good level after learning further demonstrates the effectiveness of place-based learning approaches. This finding is in line with Uttal et al. (2013), who argued that spatial thinking develops most effectively through experiential engagement and multidimensional data interpretation rather than abstract instruction alone.

In terms of professional skills, students demonstrated high levels of teamwork, situational problem-solving, and social responsibility. These outcomes align with the concept of communities of practice proposed by Lave and Wenger (1991), which emphasizes learning through participation in authentic tasks and real-world problem contexts.

Although this study relied primarily on descriptive statistical analysis, the use of multiple indicators encompassing spatial competency, professional skills, and learning satisfaction provides a systematic overview of learning outcomes. Consistent with the assessment-for-learning perspective of Boud and Falchikov (2007), the findings highlight the value of evaluation as a tool for supporting learning development rather than solely judging achievement.

Overall, this study contributes empirical evidence to the growing literature on community-based remote sensing education in agricultural contexts and offers practical implications for designing geospatial learning activities that are context-sensitive, community-oriented, and aligned with professional practice.

Recommendations

The community-based experiential learning (CBEL) approach can be extended to other geospatial courses to enhance students' spatial competence and professional skills. Future research should apply inferential statistical methods to compare experimental and control groups to further evaluate the effectiveness of CBEL in remote sensing.

Acknowledgement

The authors would like to express their sincere appreciation to the coconut farming communities in Samut Songkhram Province, as well as local organizations that provided data and access to the study sites. The authors also gratefully acknowledge Suan Sunandha Rajabhat University for its academic and instructional support, which contributed significantly to the successful completion of this study.

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