Research on Primary School Study-Travel Pathways from the Perspective of PBL Learning—A Case Study of Lishui Region

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Abstract: In current elementary school field trip practices,the issues of "traveling without learning" and "learning without research" have become increasingly prominent.These problems primarily manifest as fragmented knowledge due to poorly designed inquiry activities and the inability to transfer competencies because outcomes remain disconnected from real-world contexts.To address this dilemma,this study constructs a field trip practice framework based on project-based learning principles,centered on the logical sequence of "context-driven—problem inquiry—collaborative outcome creation."This framework effectively promotes students' knowledge integration and competency internalization by creating authentic learning environments,designing progressive inquiry tasks,and facilitating diverse outcome transformations.Empirical evidence demonstrates that this approach significantly enhances students'problem-solving abilities,collaborative learning depth,and ecological literacy,while achieving high parental satisfaction and community revisit intent.It provides a replicable practical paradigm for competency-oriented study tour curriculum reform.

Keywords: field study travel; elementary school; project-based learning; PBL

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Since the Ministry of Education and 10 other departments jointly issued the "Opinions on Promoting Study Travel for Primary and Secondary School Students" in 2016,explicitly incorporating it into K-12 educational plans[1],its institutional foundation has gradually solidified.The "Compulsory Education Curriculum Plan and Standards (2022 Edition)" further emphasized its educational value by "focusing on core competencies"[2].However,the insufficient integration of research-based learning into formal curricula remains a prominent issue in practice.This manifests as disconnects between activity objectives and core competencies,weak content alignment with existing curricula,and superficial inquiry designs.[3].Project-based learning,characterized by "authentic problem-driven,student-centered inquiry," offers potential solutions to these challenges.Yet,its systematic incorporation into regional research-based learning curricula remains an under-researched area.[4] .Therefore,this study takes Lishui City as its field of practice,constructing a PBL-oriented "Scenario-Driven—Problem Inquiry—Co-Creation of Outcomes" three-loop research-based learning model.It aims to provide a replicable practical pathway for competency-oriented research-based curriculum reform.

一、Case Introduction

The "Scenario-Driven—Problem Exploration—Co-Creation of Outcomes" three-loop research-based learning pathway developed in this study (see Figure 1).The scenario-driven phase integrates ecological and cultural resources to construct authentic learning environments;the problem-inquiry phase leverages emotional engagement as intrinsic motivation to drive deep student participation;and the outcome-co-creation phase achieves outcome construction and value elevation.This pathway fully embodies PBL's core principles of "authentic problem-driven learning,student-centered inquiry,and outcome-oriented output,"ultimately realizing competency-oriented educational goal[5].

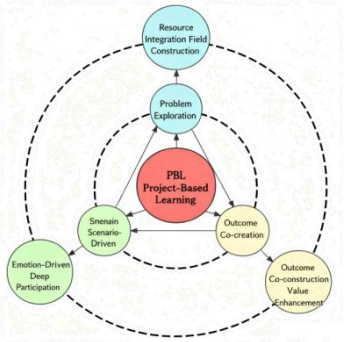

Figure1 Operational Flowchart of the Three-Ring Model

(1)First Ring:Context-Driven—Creating Authentic Learning Environments Based on Regional Resources

1.Resource Vehicle:Educational Transformation Across "Ecology + Culture" Dimensions

The context-driven phase establishes authentic learning environments to foster intrinsic motivation and bridge experience with cognition.Capitalizing on Lishui's dual assets as a national ecological demonstration zone and a primary She ethnic settlement,we transform education through its unique ecology and culture.Through systematic selection and educational adaptation of Lishui's ecological and cultural resources,we developed a core competency-oriented thematic content system:Leveraging the Jiulong Wetland ecosystem to create the "Oujiang Wetland Carbon Sink Exploration" theme,guiding students to investigate carbon sink mechanisms[6];Uncovering the symbolic meaning of She ethnic group's ribbon culture to form the "Intangible Cultural Heritage Revitalization" theme,preserving ethnic aesthetics[7];Building on the wisdom of the Tongji Weir project to construct the "Ancient Weir Irrigation STEM Transformation" theme for technical inquiry.This study educationally curates these resources,discarding purely aesthetic elements to focus on content that integrates multidisciplinary knowledge (science,language arts,art,labor education),aligns with elementary students'cognitive levels,and possesses inquiry depth,ensuring the full realization of the resources' educational value.

2.Theme Selection:Three-Dimensional Theme Design Guided by Core Competencies

During the theme selection phase,we established a framework centered on "competency orientation,disciplinary integration,cognitive alignment." For competency orientation,"Exploring Carbon Sinks in the Oujiang Wetlands" cultivates scientific inquiry and social responsibility through field observations and measurements,aligning with curriculum standards for "scientific concepts" and "ecological awareness.""Revitalizing the She Ethnic Group's Colorful Ribbon Intangible Heritage" fosters cultural heritage and aesthetic creativity by interpreting patterns,interviewing inheritors,and designing creative products,addressing the core competencies of "cultural inheritance" and"creative expression."Finally,"Ancient Reservoir Irrigation STEM Renovation" integrates technology,engineering,and mathematics.Through tasks such as analyzing irrigation systems and designing smart renovation plans,it prioritizes technical application and practical innovation,aligning with the curriculum's emphasis on "interdisciplinary practice" and "problem-solving."In terms of subject integration,each theme transcends single-discipline limits to integrate knowledge from multiple fields.Cognitively,all three themes incorporate a progressive inquiry ladder,allowing elementary students to achieve success through foundational tasks while providing advanced challenges for higher-level learners.Together,these themes form a multidimensional competency framework that creates synergistic educational impact across three key domains—ecological conservation,cultural heritage,and engineering innovation—supporting holistic and personalized student development.

(II)Second Ring:Problem Inquiry—The Under-Structured Problem Package and Technology-Empowered Inquiry Process

1.Problem Design:Building an Iterative Under-Structured Problem Package

Jonathan's theory of emergent problems posits that real-world challenges often exhibit multiple

solutions,context dependency,and interdisciplinary nature,making them effective vehicles for cultivating students' higher-order thinking skills[8].This study deconstructs multidisciplinary knowledge into an "Iterative Under-Structured Problem Package,"structured as a "core-sub-task" problem framework.This interconnected and open-ended system allows students to enter from multiple points and engage in repeated inquiry cycles,facilitating sustained understanding and competency development within authentic contexts.

2.Pre-trip Preparation:Activating Prior Knowledge and Generating Initial Hypotheses

Pre-trip:Employ a combined strategy of "micro-lessons + KWL charts + pre-research tasks" to activate students' prior knowledge and guide them in establishing an initial inquiry framework:Pre-trip micro-lessons provide thematic background knowledge and foundational tool usage;KWL charts help students organize what they know (K),what they want to know (W),and reflect on what they learned (L) post-study tour,while generating testable initial hypotheses based on "W";Groups collaborate on preliminary research,gather initial materials,and develop a problem-based research report.

3.In-Class Inquiry:Technology-Empowered Collaborative Evidence Puzzling

The in-process phase leverages group collaboration,smart tools,and cloud platforms to build a technology-supported collaborative inquiry environment.RFID task cards serve as the core tools for task delivery and process guidance,with tiered task paths designed for different themes.For instance,in the "Revitalizing She Ethnic Group's Colorful Ribbon Intangible Heritage" theme,task cards release three categories:"Pattern Documentation & Interpretation,""Cultural & Creative Preference Research," and "Creative Design Practice." Students scan cards to access personalized task packages and resource links,with the system automatically pushing corresponding interview outlines,survey tools,or design templates—enabling differentiated inquiry while standardizing processes.The AI teaching assistant serves dual roles as a "real-time think tank" and "analytical assistant" across themes:In the "Exploring Carbon Sinks in the Oujiang Wetlands" task,it instantly identifies and classifies plant images uploaded by students,aiding in "carbon sequestration characteristic documentation." Simultaneously,it automatically aggregates and visualizes group-measured data like pH levels and dissolved oxygen,generating draft carbon cycle diagrams to inform subsequent causal analysis and conservation recommendations.Under the "Ancient Weir Irrigation STEM Transformation" theme,the AI assistant further provides structural principle Q&A,optimization problem diagnostics,and simplified device design suggestions.This helps students grasp system operation logic and refine technological solutions[9].All data is uploaded via mobile terminals to a cloud-based collaboration platform,facilitating cross-group evidence sharing and joint verification to complete the full inquiry cycle from data collection to hypothesis refinement.

(3)Third Loop:Collaborative Outcomes—Outcome-Oriented Approach for Diverse Outputs and Value Extension

1.Diverse Outcomes:Competency Implementation Through Multi-Stakeholder Guidance

Under the collaborative guidance of diverse mentors from schools,museums,and communities,students transform their research findings into tangible outcomes through 3D printing,design proposals,video production,public awareness campaigns,and other methods.These outcomes fully demonstrate the effectiveness of the integrated "learning-research-doing" approach.(See Table3).

2.Value Enhancement:Resource Repository Inclusion and Outcome Transformation

Establish a multi-dimensional evaluation system to comprehensively assess students' performance throughout the inquiry process and their final outcomes.Outstanding achievements—such as the "Carbon Sink Guardians" initiative,"New Tales of Ribbons" cultural design,and "Ancient Reservoir Wisdom" renovation model—are incorporated into Lishui City's shared research resources repository after joint review by the "school-museum-community" mentor team,enabling regional sharing and preservation of these outcomes.Select innovative and culturally valuable outcomes are explored for conversion into blockchain-based NFT digital

assets.After technical verification of ownership rights,these NFTs are issued to the community.This approach not only grants societal recognition for students' creative labor but also channels issuance proceeds directly into ecological conservation efforts at Jiulong National Wetland Park and the preservation of She ethnic group's intangible cultural heritage—the Colorful Ribbon tradition.This creates a virtuous cycle of synergistic development across education,culture,and ecology.Through this mechanism,students tangibly experience the social and economic value of their learning outcomes,transitioning from "knowledge learners" to "social participants" and extending the value of learning into societal impact.

II.Case Analysis

To evaluate the practical effectiveness of the Three-Ring Research-Study Pathway,this study employs a quasi-experimental design.By establishing an experimental group and a control group,empirical testing is conducted across three dimensions:student core competency development,parental feedback,and community impact.This approach ensures the scientific rigor and credibility of the research conclusions.

(I)Research Design

1.Sample Selection and Distribution

Two primary schools in Liandu District,Lishui City,were selected based on comparable school size,faculty quality,and student foundational competencies.The study population comprised 186 fourth-grade students from both schools.Specifically:- School A:Two fourth-grade classes (93 students) formed the PBL research group,implementing activities through the Three-Ring Research Pathway developed in this study.- School B:Two fourth-grade classes (93 students) formed the traditional research group,conducting research activities using the conventional "visit + lecture" model.Pre-tests administered using the "Primary School Students' Core Competencies Basic Assessment Scale" revealed no significant differences between groups in problem-solving ability ($t=0.58,p>0.05$),depth of cooperative learning ($t=0.42,p > 0.05$),and ecological civilization attitudes ($t = 0.63,p > 0.05$),indicating comparability for the experiment.

3.Questionnaire Design Rationale and Dimensions

This study employs a multi-method approach to comprehensively evaluate the effectiveness of research-based learning:Regarding the assessment of students' core competencies,it references the "Framework for Core Competencies in Student Development in China"[10]The "Primary School Field Study Core Competency Assessment Scale" was developed,covering three dimensions—problem-solving ability,depth of cooperative learning,and ecological civilization attitudes—with 24 items scored on a 5-point Likert scale.The scale demonstrated good reliability and validity ($\alpha=0.923$,KMO=0.876,$p<0.001$).Additionally,a self-developed "Primary School Field Trip Parent Satisfaction Questionnaire" surveyed parental feedback across four dimensions including curriculum design and safety measures,scored on a percentage basis.Furthermore,the Lishui Field Trip Base Management Platform tracked the community revisit rate of both student groups within three months post-trip,serving as a supplementary indicator of social impact.

(II)Data Analysis

Following the experiment,SPSS 26.0 software was used to statistically analyze the data from both groups,yielding the following results:

1.Differences in Student Core Competency Development

Comparative post-test data revealed that the PBL study group scored significantly higher than the traditional study group across three dimensions:problem-solving ability,depth of cooperative learning,and ecological civilization attitudes.The effect sizes (Cohen’s d) exceeded 0.7 for all dimensions,indicating a large effect.This demonstrates that the PBL study approach significantly enhances students' core competencies (see Table4).

Table 4:Post-test Core Competency Scores Comparison (M±SD)

Dimension	PBL Research Group (n=93)	Traditional Research Group (n=93)	t-value	p-value	Cohen's d
Problem-Solving Ability	4.21±0.53	3.15±0.61	12.87	<0.001	0.82
Cooperative learning depth	4.12±0.48	3.20±0.57	11.54	<0.001	0.75
Ecological Civilization Attitude	4.35±0.46	3.08±0.59	14.23	<0.001	0.91

As shown in the table above,the PBL research group achieved significantly higher post-test scores than the traditional research group across all three dimensions—problem-solving ability,depth of collaborative learning,and ecological civilization attitudes ($p<0.001$).All Cohen's d values exceeded 0.75,with particularly outstanding performance in key indicators such as "formulating research hypotheses," "team task division," and "proactive ecological conservation behaviors." For instance,in the "Ancient Reservoir Irrigation STEM Renovation" theme:-87.1% of PBL group students proposed two or more renovation suggestions based on collected engineering data,compared to only 34.4% of the traditional group;PBL group students achieved 92.5% task completion rate versus 61.3% for the traditional group,demonstrating significantly higher team performance.Three months post-study,45.2% of PBL students participated in community environmental activities—2.5 times higher than the traditional group's 18.3%.These findings confirm PBL's highly significant and substantive enhancement of students' core competencies.

2.Parental Satisfaction Differences

Statistical analysis of parental satisfaction revealed that the PBL study tour group achieved an average satisfaction score of 89.6±7.2,while the traditional study tour group scored 66.7±8.5.This difference was statistically significant ($t=19.36,p<0.001$).Parents in the PBL group expressed highest satisfaction (92.3 points) regarding the "child's gains" dimension,particularly acknowledging improvements in their children's "proactive questioning skills" and "teamwork awareness." Their satisfaction with the "curriculum design" dimension reached 88.5 points,citing that the study tour content was "closely integrated with textbook knowledge" and offered "offered opportunities for in-depth exploration." In contrast,parents in the traditional group averaged only 62.1 points in this dimension,primarily citing "fragmented content" and "children treating it merely as recreation."Calculations show that parental satisfaction in the PBL research-based learning group increased by 34.3% compared to the traditional group,aligning with expected outcomes.

3.Community Revisit Rate Differences

Data tracked through the study-travel base management platform showed a repeat visit rate of 38.7%(36/93)among families and community groups in the PBL study-travel group,compared to 11.8% (11/93) in the traditional study-travel group—a significant difference ($\chi^2=18.65,p<0.001$).Among repeat visitors in the PBL group,63.9% cited "further exploring unresolved issues from the study tour" as their purpose,while 27.8% aimed to "share the study tour experience with family and friends." This innovative indicator demonstrates that the project-based learning approach not only enhances students' learning outcomes but also sparks sustained interest in exploring local ecological and cultural resources through deep cultural immersion and emotional connection.This fosters a virtuous cycle of "education-community" interaction,enabling educational achievements to contribute back to local cultural ecology and economy.It provides an innovative educational pathway for building a "Common Prosperity Demonstration Zone" in mountainous areas.

III.Case Summary and Reflections

(1) Value and Implications of the Research Paradigm

The paradigm value of this study manifests across three dimensions:

Theoretical Level:This study extends PBL theory from traditional classrooms to authentic regional

contexts,broadening its application in basic education.It empirically validates Dewey's "experiential learning"theory,demonstrating the effectiveness of"learning by doing" in complex real-world scenarios.Methodologically,it constructs a replicable"regional resources-to-education transformation"model,featuring poorly structured problem packages,technology-enhanced strategies,and a"school-museum-community"collaboration mechanism.This provides systematic guidance for developing research-based learning curricula in similar regions.At the policy and practice level,it offers an actionable framework for implementing competency-oriented field studies in mountainous and ecologically rich areas.It also serves as a practical reference for promoting school-home-community collaborative education and advancing sustainable regional development through educational support for local cultural and ecological preservation.

(2)Research Limitations and Future Directions

This study retains certain limitations.Regarding sample size,the research subjects were limited to 186 fourth-grade students from two primary schools in Lishui City,with restricted sample scale and grade-level coverage,necessitating further validation of the conclusions' generalizability.Geographically,the curriculum design heavily relies on Lishui's unique ecological and cultural resources,and its adaptability to regions with limited resource diversity or weaker economic foundations remains untested.Furthermore,this study primarily measured short-term effects,leaving unclear the long-term impact of the PBL model on students' academic achievement and core value formation.Simultaneously,implementing this model demands high levels of curriculum design capability,interdisciplinary teaching literacy,and collaborative capacity among multiple stakeholders (school-museum-community) from teachers,potentially posing practical challenges during widespread adoption.

Given these limitations,future research could explore the following avenues:First,conduct long-term tracking studies by collecting longitudinal data over 1-3 years to analyze the sustained impact of PBL-based research-learning on students' subject literacy and cultural identity.Second,explore deeper integration of artificial intelligence technologies,such as utilizing large language models to assist in generating personalized inquiry questions or developing adaptive learning scaffolds to reduce reliance on teacher resources.Third,conduct cross-regional comparative studies to explore localization pathways for this model in areas with different resource endowments,such as plains and coastal regions,with particular attention to simplified application strategies in resource-constrained areas to enhance the paradigm's universality and inclusivity.

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