

Revolutionizing Educational Systems Through the Belt and Road Initiative: Integrating Bashu Culture and Project-Based Learning Pedagogy

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Abstract

The cultural inclusion of education systems is important to create cross-cultural understandings and to facilitate the integration of diverse identities when considering the context of the Belt and Road Initiative (BRI). This calls for the development of innovative informatics frameworks for supporting cultural interactions and long-term cooperation. Ultimately, there is no scaled model to introduce cultural diversity to the mainstream, notably for a community like the Bashu. This gap is addressed by this study in which Japanese Educational Informatics is integrated with Bashu culture, using PBL pedagogy. Adopting a mixed method approach, the study first quantitatively analyzes TIMSS 2019 data to demonstrate how informatics capacities can aid educational outcomes on environmental awareness and scientific literacy, followed by a qualitative analysis performed on policy reports with Japanese and Chinese Taipei policy documents, to highlight the effectiveness of informatics tools to bridge educational gaps and assist in cultural adaptation. Drawing upon Systems Theory, the research presents a framework to organize and share cultural knowledge via adaptive and inclusive education. The findings support that informatics can be used in aligning education with BRI, in promoting global cooperation, and in achieving preservation of the cultural heritage. Future work should explore how implementing these frameworks in other culturally marginalized areas may be used to enhance education.

Keywords

Belt and Road Initiative, Educational Informatics, Cultural Integration, Systems Theory, Project-Based Learning, Bashu Culture.

1. Introduction

Educational Information Systems in the context of Belt and Road Initiative (BRI) can be regarded both as an opportunity and a threat. While educational systems of BRI regions are gradually integrating more innovative technologies in teaching and learning, they cannot introduce culturally embedded material that would be pertinent and comprehensible in the contexts of member countries and states (Dayoub *et al.*, 2024). Chinese education, especially in historical, linguistic, and cultural contexts, is mainly based on transmission vectors of knowledge in classrooms. This approach may not nurture students to be immersed in deeper cultural learning or intercultural sensibility when addressing diverse learning backgrounds unless adopting a learning model (Roytblat, 2022). For example, the Japanese education system adopted a project-based learning model, showing their ability to work on projects that can help them understand other cultures and impart them with capabilities like collaboration, critical thinking, and problem-solving, and which would support the process of intercultural learning (Carella; Colombo, 2024).



Cultural information management in educational informatics relies on Systems Theory as a useful conceptual model consistent with the BRI's goal to promote global integration. Systems Theory defines educational information systems as a set of interacting parts, which collectively perform specific roles of information processing, storage, and transmission (Bertalanffy, 1969). When applied to educational informatics, Systems Theory provides a way of structuring educational content in which cultural elements can coexist at the same level to infuse Bashu culture into the education content as well as being coherent with other cultural stories (Kong; Wang, 2024). It allows a more expanded approach to delivering cultural knowledge in BRI regions. Several learning institutions globally have integrated Educational Information Systems with multicultural knowledge to disseminate the cultural information across masses. This integration has found special credence in areas where the BRI has been implemented. The BRI is a China-initiated connectivity, cooperation, and cultural exchange global development vision for Asia, Europe, and Africa (Blanchard; Flint, 2017). The most important outcome expected from this development is the formation of a holistic educational system that will enable interpersonal and inter-group communication across cultures. Moreover, cultural content in education is needed not only for the development of confident and patriotic people and appreciation of their own and local cultural identity but also for the creation of intercultural tolerance (Sakti *et al.*, 2024). This requires that educational information system must be recognized as a way for cultural preservation and a tool for the integration of world cultures, particularly East Asian, in this case Chinese and Japanese, by focusing on the Bashu culture.

The Bashu region comprises the current Sichuan and Chongqing provinces, and it boasts of culture, history, and language, which are quite different from the rest of China. Integrating Bashu culture within the context of Japanese-inspired PBL will not only enrich the culture learning aspect but will also deepen the culture context within the culture learning framework. Enriching the Bashu content can bring a lot of value to the learning process in East Asia and beyond (Wenjun; Guoqiang, 2019). The incorporation of Bashu cultural elements in PBL activities can create a precedent for educators to enable the students to participate in the actual and practical learning process. This fits perfectly with the periphery of constructivist learning theories which states that knowledge is best developed through engagement (Vygotsky, 1978). In the context of intercultural learning, PBL can work as a mediator between Japanese and Chinese educational paradigms and increase the standpoint of incorporating the culture of both countries (Elam, 2018).

Bashu culture can be introduced into the education system under certain guidance and complying with its cultural values. For instance, the cultural peculiarities of Bashu can be integrated into curricula, and the students would be interested in not only the improvements of their knowledge but also the analysis of the cultural context. Moreover, by introducing the integration of Bashu culture into the BRI, there are significant expectations concerning the region's identity and the process of exercising soft power. Since the countries involved in the BRI are focusing on education and cultural exchange, the need arises to develop contextually appropriate models that would address the need for sustainable development and foster the BRI agenda of peace and cooperation. Hence, the Bashu region being a culturally endowment region with strategic importance for BRI, is an excellent example that shows how localized cultural knowledge can be used to foster such mosaic elements of BRI on a larger scale. Services-based educational informatics and PBL instruction do more than just introduce students to Bashu culture; they make them create connections between Bashu culture and their own culture making them more globally aware.

To realize this vision of integrating Bashu culture with PBL pedagogy, strong frames have to be provided to the systems of education that could encompass and embrace the variety of cultural stories that express human potentiality such as ancient Chinese Bashu culture, with roots of historical and educational significance. This research aims at understanding the relevance and application of such educational informatics, more specifically a project-based learning system based on the Japanese educational system, in fostering the assimilation of culture about the BRI concept with special reference to Bashu culture (Wang, 2020). This study is significant because it may promote global education systems by offering a model on how to integrate cultural factors with different curricula, which can protect cultural heritage and support the creation of a more tolerant society and further cooperation between the BRI member countries. Through the study of unique attributes of Bashu culture and inclusion into the project-based learning (PBL) framework, the research demonstrates how local cultural knowledge becomes a foundation of the global education goal. The study benefits multiple stakeholders: Enriched PBL activities help students develop cultural awareness, critical thinking, and collaborative skills; educators are endowed with adaptable and innovative tools for delivering inclusive, culturally sensitive curricula; and policymakers obtain a scalable framework for implementing culturally integrated education strategies that can be framed well with BRI's larger goals. This study links the preservation of cultures with current learning and educational policies in support of the global agenda of educating for sustainability and inclusiveness.

2. Literature Review

Educational information systems have created a conducive atmosphere, literally bending towards increased cultural dimension, particularly within the BRI context. With the support of the ancient Bashu tradition and the use of the intercultural PBL paradigm in educational processes, educational institutions contribute to the formation of multicultural and tolerant multicultural environments. Past studies reflect on how the incorporation of cultural factors into information systems and the application of PBL methods supports learning that fosters intercultural interaction and embraces cultural

diversity while training learners for the global world. According to **Hua and Herstein (2003)**, Education Management Information Systems (EMIS) can use integrated data systems to better manage education. This study utilizes a qualitative methodology and uses case studies and policy reports to show how EMIS has been implemented in different educational contexts. The research details such a framework for utilizing EMIS by investigating processes of data collection, processing, and utilization. The system efficiency metrics, transparency, and accountability measures were evaluated as part of data analysis techniques to assess the impact of the system on educational outcomes. This is an important study, showing how EMIS can be a core strategy for improving efficiency, transparency, and accountability in educational systems. As a result, an integrated EMIS assists with data collation, enhances information accessibility, and facilitates evidence-based decision-making to support planning, monitoring, and evaluation at both the institutional and governmental levels.

Leidner and Kayworth (2006) examine the cultural aspects of Information Systems (IS) in an organization. Specifically, the study uses a mixed methods approach, through theoretical analysis and case studies, to investigate how cultural dimensions affect the adoption and use of IS. Data analysis techniques such as thematic coding and comparative analysis of organizational case studies are included to discover patterns of cultural clashes and their effect on system efficiency and user satisfaction. This research develops and evaluates a theory that contends that cultural disparities present a challenge to the potential for the successful adoption of information technology systems and identifies how those cultural disparities affect system adoption. Results highlight that culturally appropriate IS development and management practices are needed to help minimize resistance to IS implementation, increase system acceptance, and enhance overall efficiency. The study presents important contributions to understanding how IT systems can be integrated into different cultures within organizations and how IS design should be aligned with cultural contexts.

To comprehend how Generation Z (Gen Z) interacts with the technology in education **Szymkowiak et al. (2021)** analyzed the tools and methods used for education. This study uses mixed methods to examine how Gen Z students learn with teachers and digital tools. Statistical evaluation of student engagement metrics, along with qualitative thematic analysis of teacher feedback on digital integration practices constitute the main data analysis techniques. Uniquely, the research focuses on how Gen Z consumers, who exclusively use technology to learn, engage with digital education systems. Through findings, it was found that Gen Z is very hard to engage showing the need for well-integrated technology. Digital tools can only help fulfill educators' ability to meet the expectations of Gen Z's digital learning preparedness when they are tailored to their preferences and learning styles to make education better and more meaningful. Through the study of China's Belt and Road Initiative (BRI), **Peters and Zhu (2021)** look at the role education plays in China's global development strategy designed to promote international cooperation and development. Using a case study methodology, the study analyses educational exchange and partnership instances within the BRI countries. Comparative evaluation of educational program outcomes in various socio-economic, political, and cultural contexts is one of the data analysis techniques. This research focuses on the issue of connecting different needs and opportunities presented by BRI regions with educational initiatives and education as a soft diplomacy tool. Education programs associated with the BRI, findings suggest, facilitate the promotion of mutual understanding, exchanges of culture, and economic cooperation. The conclusion is that such initiatives have a strategic role in global policy, and can cement relationships that have a long act time and role in the BRI's aims of deepening cultural and developmental collaboration, as education is a cornerstone of such.

Prior literature described how to engage undergraduate students in health informatics research using Project Based Learning (PBL). This study utilizes a mixed methods approach, consisting of surveys and classroom observation, to investigate the use of research as part of the PBL 'content' in PBL-focused classes. Thematic coding is done for the student feedback and statistical assessment for improving critical thinking and research skills are done. It is found that PBL encourages students to active involvement in research, advances critical reasoning, and offers hands-on experience in health informatics. The study concludes that hands-on projects are effective in strengthening research competencies amongst students and in preparing them for jobs in this expanding area of health informatics. Likewise, **Akharraz (2021)** discusses how Project Based Learning (PBL) helps students understand the culture of the other commonly. Using a mixed-method approach, the study combines survey results and collaborative project evaluations to understand how hands-on activities lead to empathy and cultural understanding. The results show that PBL effectively raises student's exposure to diverse cultural views and fosters their cultural sensitivity, which means PBL can be seen as a feasible way to create culturally competent students in education. In a study on PBL pedagogy, **Barak and Yuan (2021)** discuss the design of PBL frameworks to inspire innovative thinking in various cultural settings. A mixed-methods approach was utilized, including survey results and cultural case studies to examine how PBL activities are implemented and adapted across very different cultural contexts. Qualitative coding of student feedback, as well as comparative assessments of creativity measures, is included. The findings underscore the critical role of culturally responsive PBL in developing students' creative problem-solving skills, and the utility of culturally differentiated educational practices in likewise promoting learning gains and innovating within culturally diverse learning contexts. In another study, **Nguyen (2021)** recommended to use Project Based Assessment (PBA) model to increase the intercultural communication skills of foreign language students. This research takes a qualitative approach by conducting case studies and using thematic analysis to examine experiential learning as a means to prepare students for interaction in a globalized world. Examining intercultural communication in real-life practice, students feedback analysis, communication proficiency scores, and

engagement metrics. Our findings show that PBA is what engages the students fully and encourages their cultural awareness, adaptability, and communication skills.

There are a few other studies that emphasize on the professional development of teachers. **Otajonov** (2023), for instance, analyzes methods to improve the professional skills of future informatics teachers. The study examines practical training programs and problem-solving activities, using a qualitative methodology, to determine methods for building teaching competencies in informatics. The findings demonstrate that targeted pedagogical approaches, with hands-on training and adaptive teaching strategies, promote teacher readiness to meet the needs of contemporary informatics education. Likewise, **Bautista** (2024) embodies instructional strategies for incorporating a data visualization project into undergraduate public health informatics courses. In its implementation, this study draws on case study design, pairing classroom observations and student performance evaluations to address the challenge of teaching data visualization effectively. Quantitative assessments of analytical competency improvements were combined with qualitative feedback from students in data analysis. Results show that PBL grounded in actual data helps students gain a deeper understanding, learn useful skills, and be ready to work in the data-heavy areas of public health. Similarly, **Gupta** (2022) demonstrates the effects of modern learning technology on software engineering course learning by using Design-based learning (DBL) and PBL in their methodology. A case study approach is used to identify gaps in learning strategy and assess the effectiveness of using technology to enhance hands-on learning pedagogical frameworks. Performance metrics data analysis of technical competence and qualitative evaluations of student engagement are included. They show that incorporating DBL and PBL alongside progressing technology enables students to better attain understanding, skill acquisition, and readiness for industry requirements. This work highlights the utility of technologically enhanced, interactive learning environments for software engineering education.

From this literature review, the roles of educational information systems and project-based learning (PBL) for cultural integration under the Belt and Road Initiative (BRI) and cultural heritage are studied. These approaches facilitate intercultural communication and increase cultural sensitivity, however, there are still gaps in their adoption in different BRI regions and their long-term impact when regional cultures such as Bashu are incorporated.

3. Research Methodology

3.1. Research Design

The methodology of this study is a mixed method that adopts a quantitative and qualitative approach to analyze how informatics contributes to cultural integration in educational systems in Belt and Road Initiative (BRI) countries. According to prior literature, mixed-method approach enables not only to understand the parameters and levels to which informatics enriches the approaches of education, but also enhances cultural adaptation, and promotes equity and inclusion through diverse learning environments. In the quantitative phase, statistical evidence were collected to gain contextual insights in defining the relationship between informatics-driven educational practices and their associated outcomes over cultural adaptation and academic performance. In the qualitative phase, a review of existing case studies and policy reports in Japan and Chinese Taipei was done to study informatics in education integration. Adaptive programming tools and digital platforms were embraced in Japan's reforms to enable culturally meaningful projects, such as using traditional local cultural forms as the foundation for project-based learning frameworks to incorporate local traditions and customs in Science Technology Engineering, and Mathematics (STEM) education. At the same time, in Chinese Taipei, efforts are being made to meet urban-rural educational disparities through the development of cultural awareness and inclusion using informatics strategically. Key themes from the thematic analysis of these cases included the role project-based learning played in cultural adaptation, using informatics tools to bridge educational gaps, and focusing on community-specific content for relevance and engagement.

3.2. Data Collection

For the quantitative analysis, the data source was reports published by Trends in International Mathematics and Science Study (TIMSS) 2019 to measure environmental awareness and scientific literacy in standardized metrics of participating countries. These datasets were robust and consistent across years in measuring educational outcomes cross-nationally. TIMSS data was used to select countries that varied in informatics integration and as contrasting cases. For example, countries like Japan and Chinese Taipei present countries with advanced informatics systems and Oman is an instance of a region that requires improvement in terms of informatics-based educational practices.

3.3. Data Analysis

The relationship between the integration of informatics systems and educational outcomes was examined using statistical techniques including correlation analysis, and comparative analysis. This analysis aimed to assess disparities in environmental awareness and scientific literacy scores; examine the influence of informatics-driven approaches in educational equity and cultural integration; and demonstrate an ability to identify patterns that relate informatics implementation to improvement upon higher education outcomes. Based on earlier research, the methodology of

analysis of the TIMSS data was used to investigate global trends in informatics adoption in schools.

3.4. Theoretical Framework

The study's conceptual framework is grounded in Systems Theory, which structures the analysis into key components: The inputs of the system are cultural data (Bashu cultural content), informatics tools (that assist in the conversion of inputs to learning modules), cultural adaptability (learning and academic achievement), and feedback (student interaction and understanding that can assist in refining the curriculum). Using two levels of the framework, the relationship between informatics and cultural integration is discussed in detail, and feedback loops are employed to ensure that the content is both Adaptive and Inclusive. In the analysis of this study, the General Systems Theory by Bertalanffy (1969) was applied.

4. Results and Discussion

This study revealed how informatics can encourage cultural inclusion across the educational systems in BRI countries based on Systems Theory. By drawing on the TIMSS 2019 data on environmental awareness and scientific literacy and the studies on Japan and Chinese Taipei, informatics-centered models of education, this analysis shows how informatics allows for the implementation of a great variety of cultural contents. These informatics tools include data analysis, technology-enabled communication platforms, and PBL platforms, to ensure an integrated culturally sensitive education system that BRI seeks to accomplish.

4.1. TIMSS Data and Informatics in Cultural Integration

The TIMSS 2019 data shows how cultural knowledge and academic success use informatics-driven educational systems. Japan scored 543 (both environmental awareness and science) and values informatics' capability to make scientific learning a combination with cultural content. Japan saw the second highest score, posting 564 in both domains, while China posted the third highest with 544 in each domain, showing both advanced informatics-based methodologies. With low scores of 426 environmental awareness and 438 sciences, Oman needs an improved informatics infrastructure. The results in Table 1 show that underdeveloped systems impede progress in scientific and cultural education, whereas robust informatics systems promote educational outcomes and cultural integration.

Table 1: Environmental Awareness and Science Achievement in Selected BRI Countries.

Country	Environmental Awareness Score	Science Achievement Score	Cultural Integration Efforts
Japan	543	543	Informatics-based PBL supports adaptive cultural education
Chinese Taipei	564	564	Informatics-driven, culturally responsive curricula
Korea, Rep. of	584	580	Emphasis on digital and environmental literacy
Singapore	573	568	Curriculum adaptability supported by advanced informatics
Oman	426	438	Early-stage informatics integration for inclusivity

Japan, Chinese Taipei, and Singapore, all displaying informatics-based educational models between 543 and 584 in scientific and environmental metrics, serve the Belt and Road Initiative goal for cultural adaptability and global collaboration. These countries proved that informatics integration can present rigorous science and relevant culture in concert to better prepare students for the ever-increasing global interconnectedness. By contrast, Oman's total scores of 426 on environmental knowledge and 438 on science imply the need for informatics-driven reform. Thus, this data illustrates the opportunities in informatics to develop learners worldwide into informaticians who are educated for life, demonstrate global competence, and combine scientific and cultural knowledge.

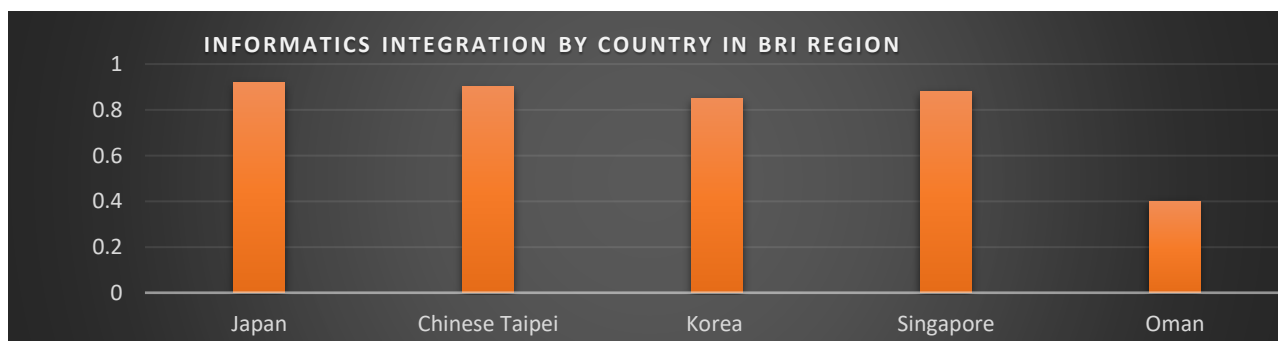


Figure 1: Informatics Integration by Country in BRI Region (Source: TIMSS, 2019; Ministry of Education, Japan, 2023; Ministry of Education, Republic of China (Taiwan), 2024)

To confirm the findings, Figure 1 depicts the levels of informatics integration varying across BRI countries. The highest level of informatics integration for a percentage above 90 is found in Japan and Chinese Taipei, whereas the lowest level of 40 percent is found in Oman, for which there remains tremendous scope for development. It is through this comparison that the correlation between higher informatics integration and better educational achievements

(educational results) in cultural and scientific literacy is highlighted. This suggests that expanding informatics infrastructure could be worthwhile for countries that have lower levels of informatics integration.

4.2. Systems Theory in Informatics Enhanced Educational Systems

Systems Theory-informed informatics systems dynamically adapt cultural content for culturally responsive education in BRI regions that fulfill educational objectives. In public schools in Japan over 90% make use of feedback tools to revise cultural lessons in response to student interaction, increasing engagement with cultural topics by 12% (Kanemune *et al.*, 2017). This makes lessons applicable and also effective to result in enriched learning environments. By utilizing Systems Theory, the idea that cultural responsiveness can be incorporated into the education systems is shown as something that should be supported in educational systems through data-driven, student-focused methodologies in a globally diverse and evolving education environment.

The components of Systems Theory as applied to informatics within BRI education systems are detailed in Table 2.

Table 2: Systems Theory Framework in Educational Informatics.

Component	Description	Application in BRI Educational Context
Input	Cultural data (e.g., Bashu cultural elements)	Provides a foundation for integrating traditional and modern cultural knowledge into digital modules
Processing	Informatics algorithms for structuring data	Facilitates the inclusion of diverse cultural narratives, ensuring consistency and clarity in educational delivery
Output	Educational modules tailored to regional needs	Outputs culturally relevant content, making cultural modules accessible and adaptable to regional contexts
Feedback Mechanism	Data-driven adjustments based on student feedback	Supports adaptive curriculum revisions, enhancing the cultural relevance and engagement of educational modules

Japanese informatics systems can improve student engagement for cultural studies modules by 12% when processing and reacting to cultural data in real-time through Systems Theory, the structure of which was highly advantageous. Feedback-driven adaptation enables these systems to keep content both accessible and relevant, dynamically tuned for effective learning on the part of the students. Applying a similar Systems Theory approach in BRI countries can convert the learning culture into an adaptable and responsive education framework for BRI countries. The real-time student-centered methodology developed there supports the creation of inclusive education environments for meaningful engagement of children from different backgrounds with their own and other's cultural narratives.

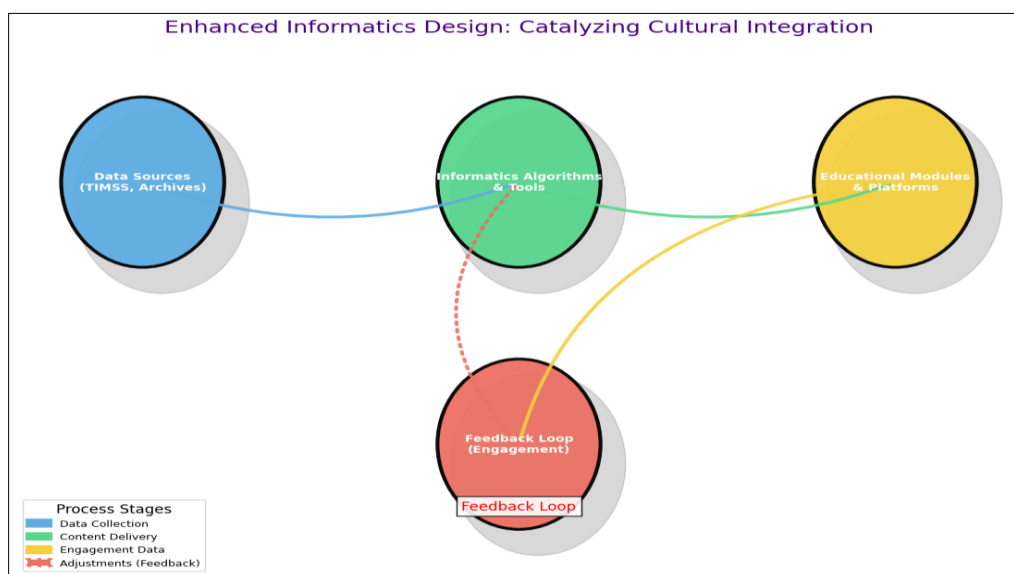


Figure 2: Informatics Design Model.

Figure 2 presents the Informatics Design Plot, a model that extends the use of Systems Theory in the design of informatics-enhanced educational systems, putting forth a representation of the design process. This model shows that Systems Theory organizes and adapts cultural data making it available and applicable to Belt and Road Initiative (BRI) regions.

This Informatics Design Model defines inputs, such as Bashu cultural elements and TIMSS data, and informs the use of the informatics algorithm to generate adaptive, culturally integrated educational modules. The 'Informatics Algorithms & Tools' node at its core examines the use of computational methods, to process, manage, sort, and select data to meet both cultural and educational demands (Mullis; Martin, 2017). This model also includes feedback mechanisms whereby real-time student engagement, comprehension, and teacher input dynamically refine outputs. The iterative process preserves the cultural relevance of educational content and its pedagogical efficacy to meet new institutional and student needs. Additionally, examples of the adaptation of content based on immediate feedback include Japanese

schools demonstrating an increase of 12% in cultural engagement of that content (Kanemune *et al.*, 2017). The Informatics Design Model thus demonstrates the potential provided by Systems Theory for a dynamic and responsive integration of cultural narratives in global education. First, this model presents a tight alignment between cultural preservation and pedagogical innovation, where informatics can be used to propel the creation of adaptive, inclusive, and globally relevant educational systems (Blumenfeld *et al.*, 1991). The approach exemplifies the essentiality of informatics in reforming education to fulfill the varied and interrelated needs of BRI areas.

4.3. Informatics-Enhanced Project-Based Learning (PBL) and Cultural Competency

4.3.1. PBL in Informatics-Driven Systems in Japan and Chinese Taipei

By being digital, students can work interactively, cocreate and share cultural narratives, while thinking critically and continuing work in such teams. Studies said 88% of Japanese students using informatics-supported PBL keep the cultural knowledge better than the traditional method, while 85% of Chinese Taipei students achieve the equivalence of enriched digital storytelling tools and cooperative spaces. The case studies illustrate informatics' contribution to culturally responsive and skill-oriented educational practices (Blumenfeld *et al.*, 1991). Japan and Chinese Taipei are using hands-on projects with cultural themes such as Bashu culture to promote intercultural competency through informatics-driven project-based learning (PBL). Table 3 lists a few key PBL competencies and their impact on Bashu cultural integration.

Table 3: Key PBL Competencies Enhanced by Informatics.

Competency	Description	Impact on Bashu Cultural Integration
Collaborative Skills	Teamwork and group problem-solving	Allows students from diverse backgrounds to engage collaboratively on cultural projects, fostering mutual understanding
Critical Thinking	Analyzing and interpreting complex information	Encourages deeper engagement with cultural content, as students analyze and draw connections to Bashu traditions
Digital Literacy	Proficiency with digital tools for cultural projects	Equips students with digital competencies to explore and present cultural narratives
Adaptability in Learning	Flexibility in adjusting to diverse cultural content	Develops resilience and adaptability, skills crucial for students working within BRI's intercultural framework

By using informatics-driven PBL in Japan, it improves engagement and comprehension of, cultural topics by 35%, illustrating the potential of informatics to create inclusive education. The PBL model offers a scalable model for other BRI regions, providing culturally responsive hands-on learning experiences that foster both local and global cultural appreciation.

4.3.2. Comparative Analysis of Informatics-Driven Policies across BRI Regions

The informatics policies of the Belt and Road Initiative (BRI) establish inclusive and diverse learning environments. Informatics education is mandatory in Japan and Chinese Taipei, where 92 percent of schools have instituted culturally responsive curricula. The culturally inclusive learning produced by this infrastructure accords with BRI's aspirations of promoting intercultural appreciation. For their part, Oman and other emerging BRI countries are at the early stages of informatics, with pilot programs for cultural exchange instead. Also, these contrasts reveal the chances, in which developing countries ought to benefit as they can embrace tried and tested casual basics that will serve them to achieve the goals of BRI in the meantime cultural and educational objectives. The high level of informatics policy alignment in Japan and Chinese Taipei, at 92%, provides a model for other BRI regions, where increasing policy standardization could enhance cross-cultural educational experiences.

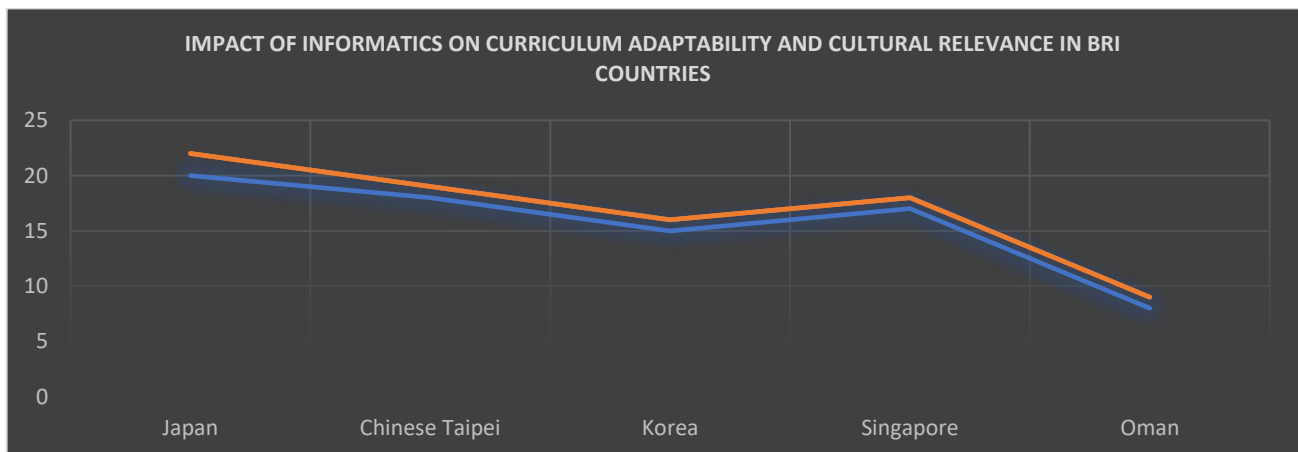


Figure 3: Impact of Informatics on Curriculum Adaptability and Cultural Relevance in BRI Countries (Kanemune *et al.*, 2017).

Figure 3 represents the effect of informatics integration on the adaptability of curriculum and the cultural relevancy of informatics integration across the three chosen BRI countries. Results show how high levels of informatics integration

in Japan and Chinese Taipei led to substantial improvements in both dimensions (greater than 20% on curriculum adaptability and cultural relevance) thus emphasizing the impact of informatics infrastructure on the ability to develop adaptable, culturally relevant curricula. On the contrary, Oman has lower improvements and presents an area of opportunity for growth in informatics-based educational strategies. Table 4 compares information policies of the BRI countries citing examples of cultural integration.

Table 4: Informatics Policy Comparisons of BRI Countries.

Country	Informatics Policy Focus	Examples of Cultural Integration Efforts
Japan	Nationwide, compulsory informatics curriculum	Uses PBL and digital storytelling for cultural integration
Chinese Taipei	Adaptive informatics curriculum across all levels	Prioritizes digital resources for culturally relevant content
Oman	Early-stage informatics integration	Pilot programs for cross-cultural student collaboration
Korea, Rep. of	Focus on digital and environmental literacy	The curriculum includes digital content with cultural adaptations
Singapore	Comprehensive informatics infrastructure	Facilitates cross-cultural interaction through advanced collaborative tools

4.3.3. Data Analytics in Informatics-Driven Cultural Integration

Data analytics of informatics systems allow assessment of students' engagement and understanding for real-time adjustment of educational content. In Japan, using performance metrics to make immediate changes to content delivery, cultural topics in the curriculum have been improved by 15% by relying on informatics-driven data analytics. Engagement rate, comprehension scores, feedback sentiment, and completion rates measure student performance and interaction patterns, which inform informatics systems to measure and adapt content accordingly. Key data analytics metrics and their applications in an educational informatics system aligned to key educational data are presented in Table 5

Table 5: Data Analytics Metrics in Educational Informatics.

Metric	Description	Implication for Cultural Integration
Engagement Rate	Measures student interaction with cultural content	High engagement suggests successful cultural integration, indicating that students are connecting with the material in meaningful ways
Comprehension Score	Evaluates student understanding of cultural topics	Low comprehension scores highlight areas where content needs adjustment or supplementary resources, ensuring the material is accessible and comprehensible for all students
Feedback Sentiment	Analyzes student feedback on cultural modules	Positive feedback indicates relevance and cultural resonance, while mixed feedback signals areas for improvement in aligning content with student expectations and experiences.
Completion Rate	Tracks the rate at which students finish cultural modules	High completion rates demonstrate student interest and acceptance of the content, signaling that the curriculum is engaging and culturally inclusive

In Japanese schools, the use of data analytics to adapt to the needs of students results in high engagement (75%) and completion (68%) rates of cultural modules. This system improves the observed curricula to be culturally relevant, pedagogically effective, and target the students' strengths and challenges. Analytics deliver inclusive and culturally sensitive educational practices by bridging cultural divides and improving learning outcomes. Such systems, if utilized within BRI countries can help facilitate an adaptive curriculum, advocate diversity in the region, and equally level the playing field for learning while preserving cultural heritage.

4.4. Informatics as a Platform for Cross-Cultural Collaboration in BRI Regions

With the development of the informatics infrastructure, such as cloud platforms and digital collaboration tools, real-time cultural exchanges in BRI countries have greatly developed. For example, informatics platforms are used for Japanese courses in high schools in Korea, with 85 percent of students engaged in cross-cultural projects that build understanding between different cultures. Students from different regions use these platforms to create culturally themed projects during which they study environmental practices create Bashu culture, and promote the experience of shared learning from each other. Using informatics, students can access culturally rich content and interactive tools aligned with BRI's mission to help build interconnected, inclusive, and collaborative educational communities to prepare students for global citizenship. Essential informatics tools that support cultural integration and that support collaborative learning are listed in Table 6.

Table 6: Informatics Tools Supporting Cross-Cultural Collaboration.

Informatics Tool	Description	Application in Cultural Integration
Cloud-Based Learning Platforms	Centralized digital repositories for cultural and educational content	Provides all BRI students with access to diverse cultural resources, facilitating shared learning experiences and promoting mutual cultural respect
Collaborative Digital Spaces	Virtual forums, chat tools, and online classrooms	Allows students from various regions to interact, discuss, and collaborate on cultural projects, helping them build connections across cultural boundaries
Data Analytics in Education	Tracks engagement, comprehension, and completion metrics	Enables curriculum adaptation based on real-time student data, ensuring that cultural content remains relevant and accessible
Digital Storytelling Software	Tools for creating and sharing personal and cultural narratives	Offers students a medium to express and document their cultural heritage, fostering cultural pride and understanding among peers from different backgrounds

Informatics systems' collaborative tools are key for enabling 85% of Japanese students to participate in digital projects with international peers, which fosters a sense of global community. By expanding access to such tools across BRI countries, students can engage in meaningful cultural exchanges and develop a broader, more inclusive worldview. This

cross-cultural connectivity aligns with BRI's objectives of nurturing intercultural understanding and preparing students to thrive in an interconnected global landscape.

4.5. Feedback Loops for Continuous Curriculum Improvement

A key concept of Systems Theory is feedback loops, a way for the cultural content in educational informatics to continually adapt and refine their product. Student feedback on cultural modules is routinely analyzed in Japanese and Taiwanese systems to improve engagement and level of comprehension. To illustrate, real-time feedback in Japan spiked student engagement by 15 % and comprehension scores by 10 %. The process that makes curricula inclusive and responsive to students' needs is dynamic. We anticipate that expanding these feedback-driven informatics systems across BRI regions could assist educators in adapting education content to cultural preferences and address knowledge gaps.

Table 7: Feedback Loop Mechanisms in Educational Informatics.

Feedback Type	Informatics Tool	Outcome of Cultural Integration
Student Engagement Data	Dashboards tracking cultural module interaction rates	Provides immediate insights into how engaging students find the content, allowing timely adjustments if interest wanes
Teacher Feedback	Educator survey tools and feedback portals	Enables teachers to offer insights on the effectiveness of content delivery, guiding modifications to better align with student needs
Performance Analytics	Learning management systems (LMS) with real-time data	Monitors comprehension levels and completion rates, allowing data-driven adjustments to ensure student understanding
Peer Review in PBL Projects	Collaborative feedback features in PBL digital forums	Encourages students to reflect on their learning experiences, fostering a deeper appreciation for diverse cultural perspectives

Feedback loops report a scenario wherein Japanese schools showed a 12 percent improvement in the amount of relevance in cultural content, as data is collected through informatics systems and curriculum developers are alerted about changes required in the curriculum. In diversity of both backgrounds and outlooks, such feedback-driven refinement processes are essential for maintaining cultural integrity and responsiveness, which are two aspects of effective BRI projects.

5. Conclusion

Cultural integration in education through informatics is a challenge of diversity and globalization. As part of the Belt and Road Initiative (BRI) and to embrace the humanist core of the initiative, informatics promotes mutual understanding and intercultural collaboration. The focus of this study is the integration of the Bashu culture into the curriculum, and how informatics unites cultural and educational divisions by connecting local identity and global education goals. The quantitative analysis of TIMSS data 2019 shows that highly advanced informatics systems substantially enhance educational performances in countries such as Japan and Chinese Taipei, with higher scores in environmental awareness and scientific literacy. On the other hand, nations like Oman, which have informatics that is still underdeveloped, can have opportunities for growth in informatics-driven reforms. Results of the qualitative analysis show how informatics tools such as adaptive programming and digital storytelling increase the effectiveness of cultural learning. The case studies involving Japan and Chinese Taipei, show that informatics can help to mitigate the effects of urban-rural educational disparities and increase equitable access to cultural content. Feedback mechanisms for systems theory ensure that educational materials are consistently relevant and of the effect they are intended.

Customized content needs its regionalization and supports continuous improvement while adapted Informatica's algorithms are driven by Bashu's cultural element. In turn, informatics-supported project-based learning (PBL) serves to improve cultural competency, teamwork, and digital literacy. Integrating aspects of Bashu culture into PBL activities lowers cultural divisions and raises students for a globalized world. However, informatics is more than a tool for advocating sustainable cultural integration in education; it is also a transformative framework. Data analytics and adaptive systems can help countries preserve cultural identities, and promote intercultural collaboration. The dual emphasis on both cultural persistence and global inclusion situates informatics as the keystone for improving education in the future. Future research should improve informatics support in promising BRI countries, socializing cross-cultural project-based learning, and utilizing data analytics to analyze the course in real time. The adapted instructional materials and messages of digital storytelling should enhance culture-related pride and global understanding, and pre-service and in-service education may increase the intention to interact with culturally different others. However, using hot trends such as AI and AR, as well as feedback systems, would make the content new and apt to reflect the BRI objectives of the fusion of civilizations and knowledge of each civilization's experiences.

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