The Development of the Kolb Learning Style Inventory (KLSI): Evolution, Validity, Flexibility and Its Application in Education

Taufik Samsuri [1], **Putu Budi Adnyana** [1], **I Putu Wisna Ariawan** [1], **I Gede Astra Wesnawa** [1]

[1] *Ganesha University of Education*
Jl. Udayana No11 81116, Singaraja Bali, Indonesia

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Corresponding Author:
Taufik Samsuri
taufiksamsuri@undikma.ac.id

Abstract. The Kolb Learning Style Inventory (KLSI) has progressed through various revisions to refine its validity, reliability, and adaptability as a tool for identifying individual learning styles based on Kolb's Experiential Learning Theory. This study reviews the development of KLSI from its initial version to the latest KLSI 4.0, examining major modifications and their impact on educational applications. Each version addressed previous critiques by enhancing psychometric properties and incorporating features such as adaptive learning flexibility and expanded normative data, making KLSI more relevant across diverse educational contexts. Key findings indicate that while these advancements support more personalised and flexible instructional strategies, certain limitations remain, particularly in capturing learning preferences' dynamic and culturally influenced nature. This study contributes to a comprehensive understanding of KLSI's evolution and its implications for promoting learner-centred education. It highlights future directions for improving its applicability in globalised and diverse learning environments.

Keywords: Kolb Learning Style Inventory; Experiential Learning Theory; Learning styles; Educational application; Adaptive learning.

INTRODUCTION

David Kolb's Kolb Learning Style Inventory (KLSI), first introduced in 1971, has been instrumental in advancing our understanding of individual learning styles, particularly in educational and professional contexts. The KLSI is deeply rooted in Experiential Learning Theory (ELT), which places experience at the centre of the learning process. According to ELT, learning is a cyclical process encompassing four essential stages: concrete experience, reflective observation, abstract conceptualisation, and active experimentation [1, 2]. This theory highlights the transformative power of experience in creating knowledge, underscoring the dynamic interaction between individuals and their environments [3]. KLSI's adaptability across diverse contexts has allowed it to evolve significantly, responding to advancements in educational research and changing professional needs.

Since its inception, KLSI has gone through several iterations, each enhancing the instrument's validity and reliability. The latest, KLSI 4.0, incorporates refinements based on empirical findings and addresses conceptual critiques. It aims to make it a more robust tool for identifying and applying distinct learning styles across various cultural and educational settings [4, 5]. The instrument's evolution reflects its foundational role in educational methodologies and its expanding relevance in fields as varied as management, healthcare, and psychology, where experiential learning plays a crucial role in cognitive and social skill development [6]. This adaptation has also extended to professional development, where KLSI facilitates cultivating adaptive and reflective skills, crucial for thriving in the fast-evolving modern work environment [7, 8].

One of the primary benefits of KLSI is its ability to categorise learners into four distinct styles: diverging, assimilating, converging, and accommodating, which reflect individual preferences in perceiving and processing information [9]. For instance, divergers are often reflective and imaginative, preferring observation and brainstorming, while convergers favour practical application and problem-solving. Educators can leverage

these insights to tailor instructional strategies that align with students' learning preferences, enhancing engagement and academic performance [10, 11]. This customisation fosters an inclusive learning environment where students feel acknowledged and supported, which is critical for engagement and comprehension [11].

In addition to aiding educators, KLSI is a diagnostic tool that empowers students to gain awareness of their learning preferences. Students can adopt more effective learning strategies by understanding their strengths and weaknesses, making them active participants in their educational journey [11]. This self-awareness is particularly valuable in higher education settings, where students are expected to take greater responsibility for their learning. Consequently, KLSI not only aids in personalising educational approaches but also encourages self-directed learning, which is increasingly vital in the digital era where independent knowledge acquisition is commonplace.

The relevance of KLSI extends beyond individual learning; it provides valuable insights into group dynamics in educational settings. Educators can design curricula that meet diverse needs by understanding the collective learning styles within a group, creating a more collaborative and practical learning experience [10]. For example, in nursing education, recognising predominant learning styles among students enables educators to develop curricula incorporating various teaching modalities, thereby improving educational outcomes and making the learning experience more engaging [12]. In professional and corporate environments, KLSI has proven valuable for team building and fostering collaborative problem-solving skills, as it highlights complementary strengths within a team.

Despite its broad acceptance, KLSI has not been without criticism. Some researchers question the reliability and validity of the instrument, citing issues in defining and measuring learning styles and interpreting the experiential learning cycle model [13]. The categorisation of learning styles is sometimes perceived as overly simplistic, failing to capture the complexity of individual learning processes. Additionally, critics argue that the model's cyclic structure might not fully accommodate daily non-linear learning experiences in modern, multidisciplinary educational and professional environments. These critiques underscore the need for continuous methodological improvements to enhance the KLSI's robustness, especially given the diverse demands of 21st-century learning contexts [14].

Addressing these critiques, recent versions of the KLSI, particularly Version 4.0, incorporate methodological advancements to improve psychometric properties and adapt the instrument to contemporary educational requirements. KLSI 4.0 emphasises user-friendliness, allowing for digital administration and adaptive learning systems that facilitate continuous feedback and reflection. These modernisations align with pedagogical approaches prioritising learner-centred education, making KLSI more applicable across educational and cultural contexts [6, 15].

Experiential Learning Theory (ELT) is the theoretical foundation for KLSI, proposing that effective learning arises from active engagement with experience followed by reflection [16, 17]. ELT's cyclical nature, encompassing concrete experience, reflective observation, abstract conceptualisation, and active experimentation, forms the basis for KLSI's design, guiding its structure for identifying individual learning preferences [18, 19]. Kolb's emphasis on reflection as a core learning component aligns with research demonstrating that reflective practices enhance learning outcomes by enabling students to connect theoretical knowledge with practical application [16, 20]. This reflective process is embedded within KLSI, allowing the learners to assess their strengths and challenges, which fosters personal growth and supports self-directed learning.

One of the advantages of using KLSI lies in its integration into various pedagogical frameworks, allowing educators to employ diverse instructional strategies to cater to varied learning styles [20, 21]. This flexibility is crucial in fields such as medical education, where different learning styles necessitate adaptive teaching methods to facilitate complex knowledge and skill acquisition [22, 23]. For example, aligning teaching approaches with students' learning styles in medical training has improved knowledge retention and procedural skills, benefiting both the individual learner and the broader healthcare system.

The developmental trajectory of KLSI reflects a conscious effort to address the limitations of earlier versions while enhancing its relevance in contemporary education. The initial version, KLSI 1.0, faced criticism for its limited psychometric robustness, relying on a binary classifica-

tion system that inadequately captured the nuances of learning preferences [24, 25]. Subsequent versions introduced significant refinements, particularly KLSI 2.0, which expanded the number of items and revised scoring to better distinguish between the four learning styles [26]. These changes enhanced the instrument's psychometric reliability, aligning it more closely with Kolb's ELT principles and making it more applicable across educational settings [27].

The development of KLSI Version 3.0 saw further improvements, with rigorous psychometric testing and statistical validation addressing issues of reliability and validity. This iteration also provided more precise guidelines for interpretation, making it easier for educators to apply insights from the inventory to their teaching practices [28]. The latest version, KLSI 4.0, has embraced modern educational technologies, such as online assessments and adaptive learning systems, to support learner-centred approaches that emphasise continuous feedback and reflection [29]. This user-centred design aligns with the growing demand for personalised learning experiences, making KLSI a versatile tool for contemporary educational and professional development.

Based on the description, KLSI has undergone extensive refinement to remain relevant and effective as a learning style assessment tool. Despite ongoing critiques, many acknowledge its utility in personalising learning and enhancing educational outcomes. As education and work environments evolve, KLSI's focus on experiential learning and reflective practices positions it as a valuable tool in fostering self-directed, adaptable learners equipped to navigate complex, dynamic environments. This paper examines the evolution of KLSI and its applications in education and professional development, highlighting its role in promoting experiential learning through reflective engagement and active participation.

METHODS

This study utilised a comprehensive collection of literature sources, including academic journal articles, reviews, and case studies related to developing and applying the Kolb Learning Style Inventory (KLSI); primary resources focused on published versions of KLSI from Version 1 to Version 4, along with their corresponding user manuals and psychometric assessment reports. Additionally, supporting literature on Experiential Learning Theory (ELT) and its applications in diverse educational settings was included to contextualise the KLSI's theoretical foundation. This research also referenced empirical studies analysing the reliability, validity, and cultural adaptability of KLSI in various educational and cultural environments, providing insights into the practical applications and limitations of each version of the instrument.

RESULTS AND DISCUSSIONS

Based on the literature review results, researchers found that David A. Kolb developed KLSI Version 1 in 1971 as part of a curriculum project at MIT to help students better understand their learning styles. This first version was based on Kolb's Experiential Learning Theory (ELT), which emphasises the importance of experience as a significant component in the learning process. ELT states that learning is an outcome and a continuous cycle through which experience is transformed into knowledge. KLSI 1 consists of nine items, each of which requires respondents to rate four statements representing different learning modes: Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC), and Active Experimentation (AE). These modes align with different learning approaches, ranging from learning through direct experience to testing ideas through action, creating a profile that helps individuals identify their learning preferences. Table 1 shows each version's Kolb Learning Style Inventory (KLSI) development and essential changes.

Table 1 provides a chronological overview of the development and refinement of the Kolb Learning Style Inventory (KLSI), highlighting key changes, objectives, advantages, and limitations associated with each version. The initial version, KLSI 1, introduced in 1971, laid the groundwork for understanding learning styles within Kolb's Experiential Learning Theory (ELT) framework. This version focused on four primary learning modes – Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC), and Active Experimentation (AE). However, early limitations such as low internal reliability and test-retest consistency signalled the need for improvements.

Table 1 – Kolb Learning Style Inventory (KLSI) development and essential changes in each version

KLSI Version	Year	Major Changes	Purpose and Impact	Advantages	Limitations
KLSI Version 1	1971	Introduced with nine items covering four learning modes: Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC), and Active Experimentation (AE).	It helps individuals understand their learning style based on Experiential Learning Theory (ELT). Used in educational and business settings to support experiential learning processes.	The first tool to identify learning styles Provides a research foundation for experiential learning models.	Low internal and test-retest reliability. Simple and limited structure, lacking accuracy in providing a detailed learning profile
KLSI Version 2	1985	Increased items to 12 per scale. Improved sentence format and scoring structure	Increases internal and test-retest reliability, providing more consistent results. Accommodates various demographics for normative reference	More accurate and comprehensive in assessing learning styles. Widely accepted in research and multiple disciplines.	The forced-choice scale makes data ipsative. Results may vary depending on the situation.
KLSI Version 2a	1993	Experimented with the randomised format for learning scale items	Reduces respondent bias that may develop specific answer patterns. Aims to improve test-retest reliability.	Slight improvement in test-retest reliability. Reduces memory effects on results	Limited reliability improvement. The random format may confuse some users.
KLSI Version 3	1999	Adopted random format and colour coding. More comprehensive interpretation guidelines for each learning style	It helps respondents understand their learning style profile in a continuous learning cycle. Expands KLSI use across various fields.	More detailed interpretation guidelines. Widely used in learning style studies.	Random format and color-coding may confuse some users.
KLSI Version 3.1	2005	Updated normative data with over 6,977 respondents. Emphasis on external validity.	It provides more reliable results applicable to a broader population and increases relevance for cross-cultural research.	Higher external validity. More detailed interpretation reports for users.	Normative standards may not fully meet specific individual or contextual needs.
KLSI Version 3.2	2013	Researchers developed nine detailed learning styles. Replacing the four basic styles model – with more in-depth interpretation guidelines.	Provides a more personalised view, capturing subtle variations in learning preferences Accommodates various learning styles in different contexts	More detailed nine learning styles. Improved validity and reliability.	The complexity of the nine learning styles may confuse some users. Requires deeper reflection from respondents
KLSI Version 4.0	2011	Introduced measurement of learning flexibility. A larger normative sample with 10,423 users. Enhanced personal interpretation report.	Encourages users to develop flexibility in various learning contexts. Becomes a popular instrument in adaptive learning research	Emphasises adaptive learning flexibility. More comprehensive interpretation reports are applicable across applications.	The complexity of the nine styles and learning flexibility may be confusing. Requires an in-depth understanding of the learning cycle

In 1985, KLSI Version 2 was launched, expanding the number of items to enhance reliability and introducing a "forced-choice" scoring method, which, although practical, created ipsative data that might vary based on context. Subsequent

versions, such as KLSI 2a (1993), experimented with randomising item formats to reduce respondent bias, which improved test-retest reliability. The more detailed and color-coded KLSI 3 (1999) improved usability and interpretation, but complexity in format presented challenges for some users.

KLSI Version 3.1 in 2005 and Version 3.2 in 2013 added more extensive normative data and expanded to a nine-style model, providing more personalised assessments to capture nuanced learning preferences. By 2011, KLSI Version 4.0 emphasised learning flexibility with a larger normative sample and enhanced reporting capabilities, supporting its application in adaptive learning contexts. While these later versions offer increased accuracy and adaptability, the growing complexity requires a more profound understanding from users, especially when applying the nine-style learning model.

The table illustrates the progressive advancements in KLSI's design and application. It reflects efforts to address theoretical and practical critiques, enhancing its role as a robust tool in experiential learning research and educational practice.

Findings on KLSI Versions and Key Revisions. Table 1 outlines the development of the Kolb Learning Style Inventory (KLSI) across its significant versions, each representing methodological and structural advancements aimed at enhancing the instrument's validity, reliability, and educational applicability. KLSI Version 1, introduced in 1971, consisted of 9 items representing Kolb's four learning modes – Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC), and Active Experimentation (AE) (KLSI Versi 1, Table 1). While foundational, this version demonstrated low internal reliability and test-retest consistency, limiting its accuracy in capturing detailed learning profiles. KLSI Version 2, released in 1985, addressed these issues by expanding to 12 items per scale and refining the scoring format, significantly improving reliability and yielding more consistent results across different demographic groups (KLSI Versi 2, Table 1). However, this version retained an ipsative "forced-choice" scale, which could lead to situationally variable outcomes.

Further revisions in KLSI Version 3 adopted randomised item formats and colour-coded scales, introducing more comprehensive interpretation guidelines that assisted users in understanding their learning styles within a continuous learning cycle (KLSI Versi 3, Table 1). By KLSI Version 4.0, released in 2011, enhancements included a larger normative sample (10,423 respondents) and a focus on adaptive learning flexibility, which made it particularly relevant for contemporary educational environments that require adaptability across various contexts (KLSI Versi 4.0, Table 1). This version also introduced a nine-style framework for a more nuanced understanding of learning preferences, although its increased complexity could pose challenges for some users.

Comparison with Literature and Advantages of the Current Research. The KLSI's developmental trajectory, as shown in Table 1, aligns with findings in prior studies that emphasise the need for continuous refinement of learning style instruments to address evolving educational demands and cultural diversity. Past research has frequently highlighted the limitations of early KLSI versions, particularly regarding reliability and cultural adaptability [24, 30]. By detailing each version's advancements, this study provides a cohesive overview of how these updates have systematically addressed previous critiques. For instance, KLSI 4.0's incorporation of adaptive learning measures aligns well with current demands for educational tools that support flexible and personalised learning, as authors [29] noted in the context of digital education. This comprehensive historical review of KLSI underscores its relevance as an adaptable tool capable of evolving with educational needs.

Importance of Findings and Implications for Educational Practice. The progressive changes across KLSI versions reflect the instrument's adaptability to a broad range of educational applications, with each version enhancing its potential to identify diverse learning styles effectively. These improvements have practical significance for academic practice, as the KLSI's structured framework enables instructors to better align teaching strategies with students' unique learning preferences, fostering a more inclusive and supportive learning environment. The introduction of adaptive learning features in KLSI 4.0, for instance, supports educational environments where diverse learning styles must be accommodated, especially in fields that require individualised skill development, such as medical and engineering education. These findings also underscore the need for ongoing refinement of educational assessments to support effective learning in increasingly multicultural and digitalised settings,

making the KLSI a valuable tool for promoting engagement, retention, and flexibility in learning.

Findings on KLSI's Practical Applications and Educational Impact. The advancements in KLSI across its versions have had substantial practical implications for its application in educational contexts. The enhanced reliability and validity introduced in versions 2 through 4 have enabled a more accurate assessment of learning styles, allowing educators to tailor their instructional methods effectively. Studies indicate that KLSI-based assessments can improve educational outcomes, particularly in disciplines requiring experiential learning, such as medical, engineering, and nursing education [10, 12]. Table 1 illustrates how each version's unique improvements – such as the enhanced reliability in KLSI 2.0, the structured interpretative guidelines in KLSI 3.0, and the adaptive learning flexibility in KLSI 4.0 – have progressively supported its effective use in diverse educational and professional training programs. These applications demonstrate KLSI's utility as a diagnostic tool for identifying individual learning preferences and creating adaptive, learner-centered educational experiences.

Comparison with Literature on Educational Applications and Advantages of the KLSI. The literature underscores the value of the KLSI in improving educational outcomes when instructional approaches are aligned with students' learning styles. Compared to earlier studies that mainly focused on theoretical critiques, recent research validates KLSI's practical benefits, noting that students exhibit greater engagement and comprehension when learning experiences align with their identified learning styles [11]. While some researchers argue for a more fluid approach to learning assessments due to the dynamic nature of learning preferences, the KLSI's structured, empirically refined approach has shown considerable success in various fields, offering practical advantages over other less-validated tools [21]. This study contributes to the literature by synthesising KLSI's version-specific impacts, providing a cohesive framework highlighting its evolving adaptability to modern pedagogical demands.

Importance of Findings and Implications for Adaptive Learning. The findings indicate that the KLSI's progression has enhanced its relevance in contemporary education and strengthened its role in promoting adaptive, learner-centred approaches. KLSI Version 4.0 focuses on flexibility and adaptive learning, demonstrating an understanding of the diverse learning environments in today's educational landscape, where educators increasingly prioritise instructional adaptability. This capacity for adaptation is particularly crucial in fields requiring hands-on learning, where flexible instructional approaches are essential for skill development [12]. The findings underscore the importance of aligning learning assessments with instructional design, supporting that tools like KLSI can foster more inclusive, responsive, and effective learning environments by allowing educators to adapt their methods to meet the needs of diverse learner profiles.

Findings on Cultural Adaptability of KLSI. The analysis of the KLSI versions shows an incremental awareness of the need for cultural adaptability, with each version addressing aspects that enhance its relevance across diverse cultural contexts. KLSI Version 3.1 introduced updated normative data from a larger and more varied sample size, reflecting increased attention to external validity and cross-cultural applicability (KLSI Versi 3.1, Table 1). This revision aimed to provide results more representative of different cultural and demographic groups, a necessary advancement given critiques that earlier versions did not fully account for cultural differences in learning preferences (Joy & Kolb, 2009). Furthermore, the nine learning styles introduced in KLSI Version 3.2 allowed for a more personalised assessment, capturing subtler variations in learning preferences that may be influenced by cultural background (KLSI Versi 3.2, Table 1).

Comparison with Literature on Cross-Cultural Applications and Advantages of KLSI. Recent studies in cross-cultural education emphasise the challenges in applying standard learning assessments across diverse populations, underscoring the significance of KLSI's revisions to improve cultural adaptability [2, 30]. Compared to other assessments that lack culturally sensitive adaptations, the KLSI's gradual updates, particularly in versions 3.1 and 4.0, have more successfully accommodated diverse learner needs [20]. This evolution aligns with recent research advocating for educational tools incorporating cultural variables, enabling more accurate and meaningful assessments [2]. This study thus highlights KLSI's strategic enhancements in response to cultural critiques, positioning it as a relatively robust tool for international and multicultural educational contexts.

Importance of Findings and Implications for Global Education. The KLSI's evolution toward greater cultural adaptability is particularly relevant in globalised education, where educators often work with students from varied backgrounds. By providing culturally inclusive assessment options, the KLSI enables educators to develop instructional strategies that respect and reflect the diverse learning preferences of their students, which is essential for fostering an inclusive educational environment [30]. These findings underscore the importance of culturally adaptable learning assessments in promoting engagement and retention among diverse student populations, reinforcing the KLSI's utility as an effective tool for global educational applications.

Findings on KLSI's Flexibility and Adaptive Learning Features. KLSI Version 4.0 introduced significant enhancements focused on flexibility and adaptability, addressing the need for a learning assessment tool to accommodate evolving educational environments. Table 1 shows that this version added adaptive learning capabilities by emphasising learning flexibility, allowing educators to understand better how students might adjust their learning approaches in various contexts (KLSI Versi 4.0, Table 1). This flexibility is particularly useful in modern educational settings where hybrid and digital learning environments require learners to engage in diverse ways, highlighting KLSI's adaptability to changing educational demands and enhancing its relevance in these dynamic contexts [29].

Comparison with Literature on Flexibility in Learning Assessments. The educational literature increasingly recognises the value of flexible learning assessments, particularly in medical and engineering education, where students benefit from adaptable learning methods to manage complex content [11, 12]. The enhancements in KLSI 4.0 align with these needs, as they allow educators to assess fixed learning styles and the degree of flexibility students display in adapting their learning processes. Compared to earlier research emphasising the rigidity of standard learning assessments, KLSI's recent updates demonstrate a forward-thinking approach that accommodates the fluid nature of learning preferences, providing an advantage over assessments that lack such adaptability [21].

Importance of Findings and Implications for Flexible and Personalised Learning. The emphasis on learning flexibility introduced in KLSI 4.0 supports a learner-centred approach essential in today's adaptive learning environments. By allowing students and educators to recognise and leverage flexible learning styles, the KLSI encourages a personalised learning experience that accommodates shifting educational contexts, such as online or blended learning formats. These findings are particularly relevant for designing instructional strategies that respond to students' changing needs, fostering resilience in learning, and enhancing educational engagement and retention. The flexibility feature of KLSI 4.0 underscores its role as a valuable tool for promoting adaptive learning strategies that cater to the diverse needs of modern learners, thus strengthening the instrument's application in contemporary and future educational frameworks.

Findings on Limitations and Criticisms of KLSI. Despite its ongoing evolution, the KLSI continues to face certain limitations, particularly its ability to capture the full complexity of individual learning styles. For example, although KLSI Version 4.0 incorporates adaptive learning flexibility, its structured categories may still oversimplify the dynamic and situational nature of learning preferences, as evidenced by variations in test-retest results in some studies [24]. Additionally, the KLSI's reliance on ipsative scoring limits its ability to measure absolute learning style preferences, as responses are relative rather than independent, which can complicate the interpretation of results in specific contexts (KLSI Versi 2, Table 1). These limitations suggest that, while KLSI has improved reliability and usability, challenges remain in achieving an entirely comprehensive and universally applicable assessment tool.

Comparison with Literature on KLSI's Limitations and Areas for Improvement. Research has highlighted several critiques of KLSI, especially concerning its structured approach to categorising learning styles, which some scholars argue does not fully reflect the diversity and fluidity of real-world learning behaviours [5, 13]. Compared to other learning assessments incorporating open-ended or context-sensitive measures, the KLSI's fixed categories may limit its adaptability across all learner profiles, particularly in multicultural or highly individualised educational settings. This study's findings echo these critiques, indicating that while the KLSI's revisions have expanded its applicability, further adaptations could improve its accuracy in diverse and complex learning environments.

Importance of Findings and Implications for Future Development of Learning Assessments. The ongoing critiques and limitations of the KLSI underscore the importance of continued development to enhance its effectiveness as a learning assessment tool. Future adaptations could benefit from more flexible scoring methods or context-sensitive modules that better capture the situational nature of learning preferences, enabling a more nuanced approach to understanding individual learning styles [31]. Additionally, addressing the ipsative scoring limitation could allow the KLSI to provide absolute measurements, enhancing its utility in research and practice where precision is paramount. These findings highlight that, while the KLSI remains a valuable tool in educational settings, innovations are essential to fully address learners' complex, evolving needs in diverse, adaptive, and globalised educational environments.

CONCLUSIONS

The Kolb Learning Style Inventory (KLSI) has undergone significant advancements from its initial version to the latest KLSI 4.0, reflecting a concerted effort to enhance its validity, reliability, and adaptability in educational contexts. Each version has addressed previous limitations by incorporating methodological and structural improvements, such as increased item numbers, enhanced scoring systems, and adaptive learning capabilities. These developments have strengthened KLSI's applicability across various educational fields, allowing it to support more personalised, flexible, and inclusive learning environments. However, limitations remain, particularly regarding the instrument's ability to fully capture learning styles' fluid and dynamic nature and challenges associated with ipsative scoring.

The findings underscore KLSI's value as an educational tool that promotes learner-centred strategies by aligning instructional methods with diverse learning preferences. In a globalised and increasingly digital educational landscape, KLSI's enhancements offer essential insights for creating adaptive learning frameworks that cater to the evolving needs of students. Future research should focus on developing more context-sensitive scoring methods and refining the KLSI's cultural adaptability to address these remaining gaps, enhancing its effectiveness as a comprehensive and versatile learning assessment tool. This study contributes to a deeper understanding of KLSI's role and potential in education, offering valuable directions for its continued evolution and application in diverse, complex learning settings.

Researchers recommend further refinements to the Kolb Learning Style Inventory (KLSI) based on its historical development and evaluation, aiming to enhance flexibility, cultural adaptability, and practical applicability in diverse educational contexts. Future versions of the KLSI could benefit from incorporating a hybrid scoring system that mitigates the limitations of forced-choice scoring, potentially allowing for more absolute and context-sensitive assessments of learning styles. Additionally, introducing modular sections that accommodate varied learning environments and cultural influences would allow the KLSI to better capture the dynamic and situational nature of learning, making it more applicable to a global audience. This approach would address current limitations by offering more precise, tailored insights into learning preferences across diverse settings.

It is also recommended that future developments focus on simplifying the user experience, particularly in the interpretation of results, as complexity in the latest versions may pose challenges for some users. Providing digital tools or adaptive online platforms could facilitate easier access and analysis, making the KLSI more accessible for educators and students. Integrating these tools into professional development programs could also enhance the KLSI's application in training environments, allowing organisations to support more personalised learning and team development. By focusing on these areas, the KLSI can continue evolving as a valuable tool that aligns with modern educational needs, promoting practical, inclusive, and adaptive learning experiences.

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REFERENCES

1. Kolb, A. Y., & Kolb, D. A. (2008). The learning way. *Simulation & Gaming, 40*(3), 297–327. doi: 10.1177/1046878108325713

2. Morris, T. H. (2019). Experiential learning – a systematic review and revision of Kolb's model. *Interactive Learning Environments, 28*(8), 1064–1077. doi: 10.1080/10494820.2019.1570279

3. Vongpattaranon, N. (2023). One-Wan Musical in Museum: a new normal of theatre experiential practice in the COVID-19 era. *Proceedings of the World Conference on Teaching and Education, 1*(1), 26–35. doi: 10.33422/worldcte.v1i1.38

4. Chan, C. K. Y. (2012). Using a qualitative research method, exploring an experiential learning project through Kolb's Learning Theory. *European Journal of Engineering Education, 37*(4), 405–415. doi: 10.1080/03043797.2012.706596

5. Cassidy, S. (2004). Learning Styles: An overview of theories, models, and measures. *Educational Psychology, 24*(4), 419–444. doi: 10.1080/0144341042000228834

6. Long, E. M., & Gummelt, G. (2019). Experiential Service Learning: Building skills and sensitivity with Kolb's learning theory. *Gerontology & Geriatrics Education, 41*(2), 219–232. doi: 10.1080/02701960.2019.1673386

7. Kolb, D.A. (1984). *Experiential learning: experience as the source of learning and development.* Englewood Cliffs: Prentice Hall.

8. Chiu, S. K., & Lee, J. (2019). Innovative experiential learning experience: Pedagogical adopting Kolb's learning cycle at higher education in Hong Kong. *Cogent Education, 6*(1). doi: 10.1080/2331186x.2019.1644720

9. Kurul, R., Ögün, M. N., Narin, A. N., Avci, Ş., & Yazgan, B. (2020). An alternative method for anatomy training: immersive virtual reality. *Anatomical Sciences Education, 13*(5), 648–656. doi: 10.1002/ase.1959

10. Boehm, K. S., McGuire, C., Samargandi, O. A., Youha, S. A., & Tang, D. T. (2019). The role of learning style in the changing landscape of medical Education: The Canadian Plastic Surgery Experience. *University of Ottawa Journal of Medicine, 9*(2), 46–51. doi: 10.18192/uojm.v9i2.4331

11. Hydrie, M. Z. I., Naqvi, S. M. Z. H., Alam, S. N., & Jafry, S. I. A. (2020). Kolb's Learning Style Inventory 4.0 and its association with traditional and problem-based learning teaching methodologies for medical students. *Pakistan Journal of Medical Sciences, 37*(1). doi: 10.12669/pjms.37.1.2275

12. Campos, D. G., Alvarenga, M. R. M., Morais, S. C. R. V., Gonçalves, N., Silva, T. B. C., Jarvill, M., & Kumakura, A. R. S. O. (2021). A multi-centre study of learning styles of new nursing students. *Journal of Clinical Nursing, 31*(1–2), 111–120. doi: 10.1111/jocn.15888

13. Bergsteiner, H., Avery, G. C., & Neumann, R. (2010). Kolb's experiential learning model: critique from a modelling perspective. *Studies in Continuing Education, 32*(1), 29–46. doi: 10.1080/01580370903534355

14. Kayes, A. B., Kayes, D. C., & Kolb, D. A. (2005). Experiential learning in teams. *Simulation & Gaming, 36*(3), 330–354. doi: 10.1177/1046878105279012

15. Loo, R. (2004). Kolb's learning styles and learning preferences: is there a linkage? *Educational Psychology, 24*(1), 99–108. doi: 10.1080/0144341032000146476

16. Ahn, J. (2008). Application of the Experiential Learning Cycle in Learning from a Business Simulation Game. *E-Learning and Digital Media, 5*(2), 146–156. doi: 10.2304/elea.2008.5.2.146

17. Trinh, M. P., Van Esch, C., Martinez, H. A., & Messer, T. (2021). Appreciating large classes: Using appreciative inquiry to foster a hospitable learning space for experiential learning. *Organisational Behavior Teaching Review, 45*(5), 786–819. doi: 10.1177/1052562920980125

18. Hydrie, N. M. Z. I., Naqvi, N. S. M. Z. H., Admin, N., & Admi, N. (2021). Assessing learning styles of medical students using Kolb's learning style inventory and their association with preferred

teaching methodologies. *Journal of the Pakistan Medical Association*, 1–13. doi: 10.47391/jpma.1437

19. Li, C., Yang, Y., & Jing, Y. (2022). Formulating teaching strategies for graduation internship based on the experiential learning styles of nursing undergraduates: a non-randomised controlled trial. *BMC Medical Education, 22*(1). doi: 10.1186/s12909-022-03221-0

20. Senok, A., John-Baptiste, A., Heialy, S. A., Naidoo, N., Otaki, F., & Davis, D. (2021). Leveraging the added value of experiential Co-Curricular programs to humanise medical education. *Journal of Experiential Education, 45*(2), 172–190. doi: 10.1177/10538259211021444

21. McCord, M., Houseworth, M., & Michaelsen, L. K. (2015). The integrative business experience: real choices and real consequences create real thinking. *Decision Sciences Journal of Innovative Education, 13*(3), 411–429. doi: 10.1111/dsji.12070

22. Chen, L., Jiang, W., & Zhao, R. (2022). Application effect of Kolb's experiential learning theory in clinical nursing teaching of traditional Chinese medicine. *Digital Health, 8,* 205520762211383. doi: 10.1177/20552076221138313

23. Engels, P. T., & De Gara, C. (2010). Learning styles of medical students, general surgery residents, and general surgeons: implications for surgical education. *BMC Medical Education, 10*(1). doi: 10.1186/1472-6920-10-51

24. Yang, J., Reed, S. D., Hass, S., Skeen, M. B., & Johnson, F. R. (2021). Is easier better than harder? An experiment on Choice Experiments for Benefit-Risk Tradeoff Preferences. Medical Decision Making, 41(2), 222–232. doi: 10.1177/0272989x20979833

25. Yeh, W., & Chang, H. (2009). Synthesis and characterisation of CP4FE4(CO)4-Functionalized terpyridine molecule and its Iron(II) and Ruthenium(II) complexes. *Organometallics, 28*(20), 5992–5997. doi: 10.1021/om900722u

26. Manderlier, B., Van Damme, N., Vanderwee, K., Verhaeghe, S., Van Hecke, A., & Beeckman, D. (2017). Development and psychometric validation of PUKAT 2·0, a knowledge assessment tool for pressure ulcer prevention. *International Wound Journal, 14*(6), 1041–1051. doi: 10.1111/iwj.12758

27. Naja, F., Hwalla, N., Fossian, T., Zebian, D., & Nasreddine, L. (2014). Validity and reliability of the Arabic version of the Household Food Insecurity Access Scale in rural Lebanon. *Public Health Nutrition, 18*(2), 251–258. doi: 10.1017/s1368980014000317

28. Maeda, S., Tsuchida, H., & Marsella, R. (2007). Allergen challenge decreases mRNA expression of regulatory cytokines in the whole blood of high-IgE beagles. *Veterinary Dermatology, 18*(6), 422–426. doi: 10.1111/j.1365-3164.2007.00630.x

29. Ferrari, A. J., Andrade, A. A., Interlando, J. C., & Severo, C. A. (2023). Characterisation of totally real subfields of 2-Power cyclotomic fields and applications to signal set design. *Journal of Algebra Combinatorics Discrete Structures and Applications*, 73–81. doi: 10.13069/jacodesmath.v11i2.207

30. Joy, S., & Kolb, D. A. (2009). Are there cultural differences in learning styles? International Journal of Intercultural Relations, 33(1), 69–85. doi: 10.1016/j.ijintrel.2008.11.002

31. Sheng, A. Y., Chu, A., Biancarelli, D., Drainoni, M., Sullivan, R., & Schneider, J. I. (2018). A novel Web-Based Experiential learning platform for medical Students (Learning Moment): Qualitative study. *JMIR Medical Education, 4*(2), e10657. doi: 10.2196/10657