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A Conceptual Exploration of Critical Thinking Style and Learning Styles: Supporting Educational Needs in Nepal

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A Conceptual Exploration of Critical Thinking Style and Learning Styles: Supporting Educational Needs in Nepal

Abstract

Agricultural education is crucial in nations such as Nepal where agriculture is the backbone of society. However, many Nepalese students face challenges due to a lack of access to a quality education, socio-economic disparities, and political instability. The diverse and evolving needs of its agricultural students need to be examined to ensure educational practices are responsive and inclusive. This study developed and tested a hypothesized integration of learning styles and critical thinking styles. A survey research design was employed, targeting agricultural education students in Nepal. The findings indicated male and female students exhibited different critical thinking styles, but their learning styles did not differ. Female students preferred seeking critical thinking styles, whereas males preferred engaging critical thinking styles; therefore, educational strategies should be tailored to encourage information seeking for female students and engagement for male students. Additionally, first-year students preferred Concrete Experience (CE) when learning, while fourth-year students preferred Abstract Experimentation (AE). Therefore, curricula should be designed to incorporate practical, real-world tasks for first-year students and more theoretical, application-based tasks for fourth-year students. The study also found significant relationships between engager critical thinking styles and AE and Reflective Observation (RO), and between seeker critical thinking styles and CE and AE. Unexpected inverse relationships were observed, indicating complex dynamics between these constructs and the need for additional exploration conceptually. The results underscore the importance of testing new conceptual models to develop structures for future study that will support the diverse and evolving needs of agricultural education students around the world.

Keywords

learning style, critical thinking style, Nepal, structural equation modeling, experiential learning

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A Conceptual Exploration of Critical Thinking Style and Learning Styles: Supporting Educational Needs in Nepal

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Agricultural educational systems can become more inclusive and effective by actively addressing the unique needs of learners (e.g. Lamm et al., 2017). Learners strive to acquire knowledge and skills that will enable them to thrive in both their personal and professional lives regardless of geographic location. However, the specific goals and aspirations of learners may vary based on their interests, backgrounds, and circumstances including cultural norms, economic opportunities, and access to resources (Mukembo et al., 2023; Myers & Dyer, 2006). Agricultural education is crucial in nations such as Nepal when striving to achieve sustainable progress. However, many Nepalese learners may face challenges due to lack of access to a quality education, existing socio-economic disparities, geographic barriers, and political instability (Bhatta, 2009).

The Nepalese education system has undergone significant changes over the past 50 years including structural reforms, curriculum revisions, efforts to improve access and quality of education, and initiatives to address socio-economic disparities and enhance educational outcomes (Bhatta, 2009). During the early 1970s, Nepal initiated efforts to expand mass education through the implementation of the 1971 Education Plan (Joshi, 2019). Later, further reforms included curriculum revisions, teacher training programs, and initiatives to promote girls' education and reduce disparities based on gender, ethnicity, and socioeconomic status (Joshi, 2019).

More recently, the educational system served as a focal point within broader social and political upheavals (Caddell, 2007; Pherali, 2013). In 2006, the Comprehensive Peace Accord was signed and in 2008 Nepal abolished the monarchy and declared itself a federal democratic republic (Joshi, 2019). Education was subsequently decentralized with decision-making power devolved from the central government to provincial and local governments. Despite the transformations to the educational system, in 2022 the Ministry of Education (Government of Nepal, 2022) found issues persisted even at the primary level despite reform efforts with over two thirds of children dropping out before graduation.

Education is crucial in nations like Nepal, that must foster economic growth and promote sustainable progress (Gyawali & Khanal, 2021; Öztürk, 2008). Given the ongoing changes occurring within the Nepalese education system, it is imperative to explore the diverse and evolving needs of its learners to ensure educational practices are responsive and inclusive. However, a significant gap exists in understanding the needs of Nepalese learners (Joshi, 2019).

Improved insights regarding the needs of Nepalese learners focused on the advancement of agriculture in Nepal may be accomplished by examining preferences for learning styles proposed by Kolb (1984), which can then inform the development of effective instructional strategies (Rudd et al., 2000). Further, critical thinking has also been identified as a fundamental cognitive skill associated with achievement (Lamm & Irani, 2011). Understanding more about critical thinking styles of Nepalese learners has the potential to provide critical insights into cognitive processes and facilitate a deeper understanding of learning contexts. Developing a framework for how Nepalese agricultural education students learn and think may help to inform educational strategies and tailor teaching methods to accommodate diverse learning preferences and associated outcomes. Although instructional approaches customized to learning styles have been investigated and validated in cultivating a diverse learner base (Kolb, 1984), the nexus of critical thinking and learning, particularly in the Global South, remains largely unexplored (Joshi, 2019).

Conceptual Framework

Kolb's (1984) learning styles and Lamm and Irani's (2011) critical thinking styles served as the conceptual framework guiding this research.

Learning Styles

Learning styles are manifested from experiential learning theory; originally developed by Dewey (1938). Kolb (1984) later elaborated on experiential learning theory to account for the individuality humans possess, identifying that learning styles are a state rather than a type. Kolb further proposed that learning occurs through a process and that new experiences integrate with previous experiences to shape the creation of new knowledge. Kolb described an individual's approach to learning and creation of new knowledge in four stages: Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC), and Active Experimentation (AE).

When a learner is in each stage, they engage with information in a unique way. For example, when a learner begins the learning process (CE), their feelings are often stronger than their thinking because of direct involvement with an experience. As they move on to RO, they reflect directly on the concrete experience as understanding the experience is more important than its technical application

(Kolb, 1984). Emphasis is then placed on thinking rather than feeling in the AC phase where generalizations and hypotheses are formed. The learner is therefore expected to analyze the experience and provide a systematic response. In the final, AE stage, the process results in new experiences with emphasis placed on doing as opposed to observing and reflecting (Kolb, 1984). The cycle then repeats as the learner engages with new experiences. While learners can engage in the entire experiential learning cycle if they have an instructor placing emphasis and offering opportunities in all four areas, some learners appreciate additional emphasis and time placed on certain stages of their learning experience (Kolb, 1984). Through the identification of learning style preferences, agricultural educators can make decisions about how time is spent in formal and non-formal environments to encourage specific aspects of learning, thereby encouraging deeper engagement and critical thinking on a specific topic (Roberts, 2006).

Critical Thinking Style

Critical thinking style describes how an individual goes about thinking and reaching solutions to a problem that does not have a clear right or wrong answer (Lamm, 2015; Lamm & Irani, 2011). The literature has indicated there is no right or wrong style of critical thinking but rather differences in approach based on a continuum between engagement and seeking information (Lamm et al., 2011; Lu et al., 2021; Wu et al., 2020). Individuals who prefer engagement when thinking critically value speaking to others and appreciate diverse perspectives. Individuals who prefer seeking information when thinking critically value finding as much information as possible about the issue prior to making a decision and moving forward toward a solution (Lamm & Irani, 2011).

Critical thinking has historically been identified as an important attribute for success (Huitt, 1998) with Paul (2002) indicating “in a world of accelerating change, intensifying complexity and increasing interdependence, critical thinking is now a requirement for economic survival” (p. 4). Despite exploration and analysis of critical thinking as a concept, the literature remains ambiguous and difficult to integrate into existing educational frameworks.

Integration of Learning Styles & Critical Thinking Style

Based on an integration of the Kolb (1984) learning style framework and the Lamm and Irani (2011) critical thinking style framework, Figure 1 presents a hypothetical conceptual model proposing the anticipated effects of critical thinking styles on learning styles. The proposed model consists of seven hypotheses:

- Hypothesis 1 (**H₁**): Engager has a significant direct effect on CE.
- Hypothesis 2 (**H₂**): Engager has a significant direct effect on AE.
- Hypothesis 3 (**H₃**): Engager has a significant direct effect on RO.
- Hypothesis 4 (**H₄**): Engager has a significant direct effect on AC.

Hypothesis 5 (**H₅**): Seeker has a significant direct effect on CE.

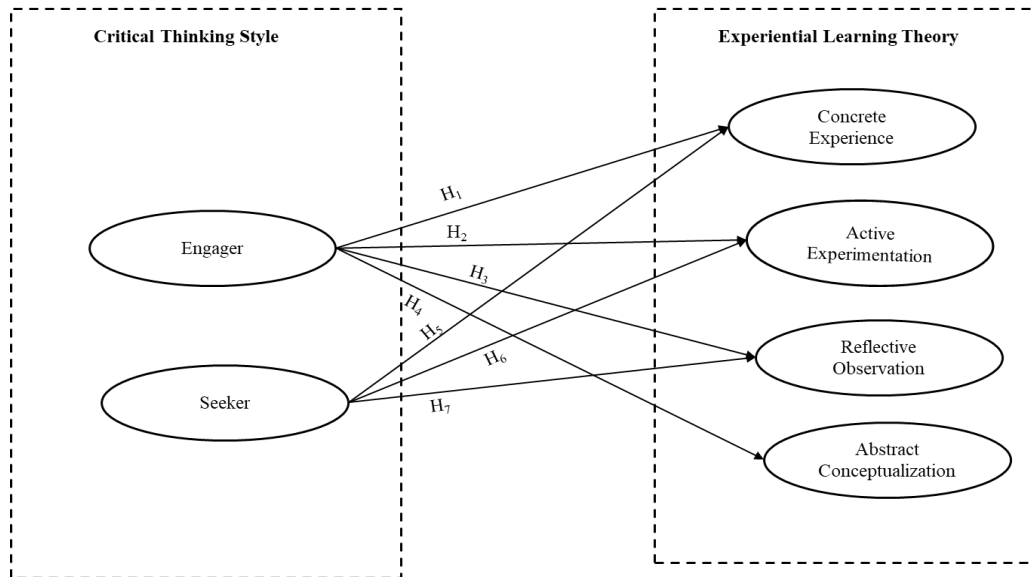
Hypothesis 6 (**H₆**): Seeker has a significant direct effect on AE.

Hypothesis 7 (**H₇**): Seeker has a significant direct effect on RO.

* All effects were hypothesized to be both significant and positive in nature.

Figure 1

Hypothesized Conceptual Framework Based on Empirical Research



Examining the relationship between critical thinking style and learning style preference may provide novel insights, supporting international agricultural educator efforts to enhance educational experiences and positively impact students' ability to think critically.

Purpose & Research Objectives

The purpose of this study was to determine if a relationship existed between Nepalese agricultural education students' learning style preferences and critical thinking style preferences amongst diverse learner groups. The objectives for the study included the following:

1. Determine if there are statistically significant differences in students' critical thinking styles and learning styles based on gender.
2. Determine if there is a statistically significant difference in students' critical thinking styles and learning styles style among students in different academic classification.

3. Determine the nature and effects of critical thinking style on learning styles.
4. Examine the moderating effects of gender and academic classification on the relationship between critical thinking styles and learning styles.

Methods

A non-experimental, cross-sectional, explanatory survey research design was used to achieve the research objectives. The research presented here was part of a larger study exploring how to best educate agricultural students to prepare them for the critical issues facing the agricultural industry. Undergraduate students Agricultural and Forestry University in Nepal majoring in agricultural education were the target population. Two parts of the online survey instrument were used for the current study: Kolb's Learning Style Inventory (LSI; Kolb, 1984) and the Critical Thinking Inventory (CTI; Lamm & Irani, 2011). The study was reviewed and determined to be exempt by the University of Georgia Institutional Review Board (STUDY00006653).

Instrumentation

A web-based survey instrument was developed using the Qualtrics online survey platform and included demographic and Likert-type questions. Two sections of the survey were utilized to address the research objectives. The first was the Learning Styles Inventory (LSI, Kolb, 1985), a previously established, reliable instrument consisting of 12 items. Respondents received a prompt and were then asked to rank their preferences amongst four options associated with four learning stages (CE, RO, AC, and AE). For example, a respondent was asked to indicate *I learn best when...* and then rank four options consisting of: *I analyze ideas*, *I am receptive and open-minded*, *I am careful*, and *I am practical*. Rank scores for responses to each learning stage were summed and ranged from 12 to 48.

Critical thinking style was measured using the Critical Thinking Inventory (CTI, Lamm & Irani, 2011). The CTI measures respondents' level of agreement to 20 items on a five-point Likert-type scale (1 = *Strongly disagree*; 2 = *Disagree*; 3 = *Neither agree nor disagree*; 4 = *Agree*; 5 = *Strongly agree*). Results are an indicator of an individual's cognitive processes when seeking and engaging with various information sources and types (Gorham et al., 2014). Of the 20 items, 13 measure seeking-oriented behaviors and seven measure engagement-oriented behaviors (Lamm & Irani, 2011). The items within each construct were averaged to create a seeking score and an engaging score. Previous studies have found the instrument reliable across contexts and cultures (Lu, 2019). Reliability tests were conducted *ex post facto* in this study confirming the stability of all measures ($\alpha > .85$).

The instrument was reviewed by a panel of experts in survey design, international development, and agricultural education and leadership to ensure content validity. The instrument was pilot tested with undergraduate students in Kenya to establish content, response process, and face validity in international settings (Lamm et al., 2020). No modifications were made to the instrument based on the pilot.

Data Collection & Analysis

Respondents who participated in the study were undergraduate students at the Agriculture and Forestry University in Nepal. A convenience sample of 218 undergraduate students enrolled in agricultural majors was obtained. Most of the respondents were of Indian descent and ranged in age from 19 to 23. Respondents represented all four years within student classification with the largest number of respondents in their degree second year (see Table 1).

Table 1

Demographics of Respondents (N = 218)

	<i>F</i>	<i>%</i>
Gender Identity		
Male	108	51.2
Female	99	46.9
Student Classification		
Degree First Year	56	26.9
Degree Second Year	62	29.8
Degree Third Year	56	26.9
Degree Fourth Year	14	6.7
Other	20	9.6

Note. Totals do not equal 100% due to nonresponse or marking prefer not to say.

Data were analyzed using descriptive statistics with SPSS 29. A two-way multivariate analysis of variance (MANOVA) was used to examine the effect of gender and classification on students learning style and critical thinking style. Univariate ANOVA was conducted as a follow-up test for statistically significant MANOVA results. Second, Mplus 8 was used to conduct structural equation modeling (SEM) path analysis to investigate hypothetical conceptual model fit. Model fit was evaluated based on recommendations within the literature (Hu & Bentler, 1999), including, chi-square test, the Comparative-Fit Index (CFI), the Tucker–Lewis Index (TLI), the Root Mean Square Error of Approximation (RMSEA), and the Standardized Root Mean Square Residuals (SRMR).

Results

Differences in Critical Thinking Style & Learning Styles Based on Gender

Objective one sought to determine if there were statistically significant differences in students' critical thinking styles and learning styles based on gender. The results of the MANOVA indicated there was a statistically significant difference in students' critical thinking style when male and female respondents were compared (Pillai's Trace = 0.05, $F_{(2, 204)} = 5.53$, $p = 0.005$, $\eta^2 = 0.05$). Specifically, female respondents were observed to have higher seeker scores, whereas male respondents tended to have higher engager scores. The results of the MANOVA indicated there was not a statistically significant difference in students' learning style based on gender (Pillai's Trace = 0.007, $F_{(3, 203)} = 0.466$, $p = 0.706$).

Differences in Critical Thinking Style & Learning Styles Based on Academic Classification

The second objective sought to determine if there were statistically significant differences in students' critical thinking styles and learning styles based on academic classification. The results of the MANOVA indicated there were statistically significant differences in students' critical thinking style between respondents in different academic classification (Pillai's Trace = 0.079, $F_{(8, 406)} = 2.08$, $p = 0.037$; $\eta^2 = 0.05$). As MANOVA assesses the overall effect across all dependent variables it is possible there is a general effect across all dependent variables, but this effect is not necessarily consistent across each variable individually.

Additionally, the results of the MANOVA indicated that there was a statistically significant difference in students' learning style among respondents in different academic classification (Pillai's Trace = 0.169, $F_{(16, 812)} = 2.245$, $p = 0.003$, $\eta^2 = 0.042$). The significance was expressed in CE and AE of learning style. For CE, the statistically significant difference was observed between the first year and the fourth-year respondents. Specifically, the first-year respondents had the highest CE score ($M = 38.09$, $SD = .64$), whereas the fourth-year respondents had the lowest CE score ($M = 33.43$, $SD = 1.28$). Regarding AE, the statistically significant difference was observed between the first-year and the fourth-year respondents, as well as between the second-year and fourth-year respondents. Specifically, the first-year respondents had the lowest AE score ($M = 23.11$, $SD = .95$) and the second-year respondents had the second lowest AE ($M = 24.52$, $SD = .91$) observations and both were statistically significantly than the fourth-year respondents who had the highest observed AE score ($M = 30.93$, $SD = 1.90$).

Table 2

MANOVA Results for Critical Thinking Style & Learning Styles Based on Gender & Academic Classification

Independent Variables	Dependent Variables	Pillai's Trace	<i>F</i>	<i>p</i>	Partial Eta Squared
Gender	Critical Thinking	0.05	5.53	0.005	0.05
	Learning Styles	0.007	0.466	0.706	—
Academic Classification	Critical Thinking	0.079	2.08	0.037	0.05
	Learning Styles	0.169	2.245	0.003	0.04

Impact of Critical Thinking Style on Learning Styles

The third objective sought to determine the impact of critical thinking style on learning styles. The mean score for CTI Engager was 48.54 ($SD = 5.93$) and the mean score for CTI Seeker was 50.04 ($SD = 4.84$). The learning styles had the following mean scores: CE, 36.24 ($SD = 4.98$); AE, 25.25 ($SD = 7.28$); RO, 28.76 ($SD = 6.19$); and AC, 29.73 ($SD = 6.41$). The correlations between different dimensions of critical thinking and learning styles are described in Table 3. The Seeker had a positive correlation with CE ($r = .133^*$) and RO ($r = .226^{**}$), but a negative correlation with AC ($r = -.217^{**}$). Conversely, the Engager was positively correlated with AE ($r = .225^{**}$) but negatively correlated with RO ($r = -.235^{**}$).

Table 3

Correlations Between Different Dimensions of Critical Thinking and Learning Styles

	CE	AE	RO	AC	Seeker
AE	-.266 ^{**}				
RO	-.170 [*]	-.502 ^{**}			
AC	-.311 ^{**}	-.443 ^{**}	-.264 ^{**}		
Seeker	.133 [*]	-0.093	.226 ^{**}	-.217 ^{**}	
Engager	-0.053	.225 ^{**}	-.235 ^{**}	0.013	-.527 ^{**}

Note. ^{**} $p < 0.01$; ^{*} $p < 0.05$

Model fit was analyzed to establish internal structure validity. Goodness-of-fit (GOF) analysis indicated the data fit the hypothesized model. Specific GOF analysis indicated the Chi-square statistic was not significant ($\chi^2 = 2.46$, $p = 0.11$), the CFI was 0.99, which is over the threshold value of 0.90, also indicating a good fit. Furthermore, the TLI was 0.85 approaching 0.90, indicating a relatively good fit (Bentler, 1990; Kim et al., 2016). The SRMR was 0.035, which is less than 0.08 indicating good fit. The RMSEA was 0.08, which is equal to the threshold value of 0.08, indicating acceptable fit. The results of the subsequent SEM path analysis partially supported the proposed hypotheses. Table 4 lists the conclusions for all seven hypotheses.

Table 4

Conclusions for Hypotheses

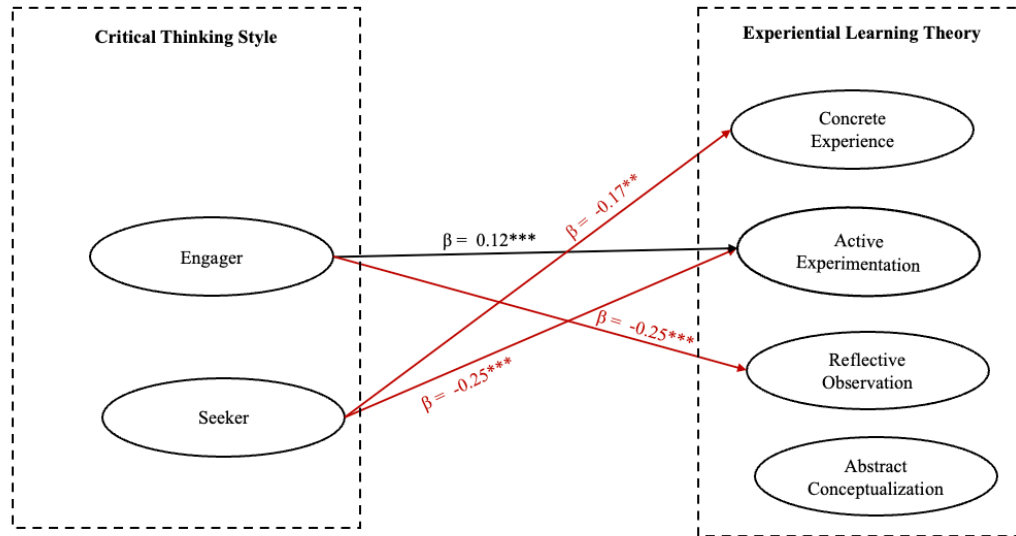
	Hypothesis	Conclusions
H1	Engager has a statistically significant effect on CE.	Not supported
H2	Engager has a statistically significant effect on AE.	Supported
H3	Engager has a statistically significant effect on RO.	Supported*
H4	Engager has a statistically significant effect on AC.	Not supported
H5	Seeker has a statistically significant effect on CE.	Supported*
H6	Seeker has a statistically significant effect on AE.	Supported*
H7	Seeker has a statistically significant effect on RO.	Not supported

**Note* – Hypotheses 3, 5, and 6 were partially supported with statistically significant direct effects observed as anticipated; however, the directionality of relationships between variables was reversed.

Given four of the hypothesis were supported, a new Critical Thinking Style Effect on Learning Style Conceptual Model (Figure 2) was developed. Hypothesis two was fully supported. Hypotheses three, five and six were partially supported with statistically significant direct effects observed as anticipated; however, the directionality of relationships between variables was reversed therefore these negative relationships are indicated in red in Figure 2.

Figure 2

Critical Thinking Style Effect on Learning Style Conceptual Model



Note. *** $p \leq 0.001$; β = standardized path coefficients; Red indicates negative effect.

Moderating Effects of Gender and Academic Classification on the Relationship between Critical Thinking Style and Learning Styles

The final objective sought to examine the moderating effects of gender and academic classification on the relationship between critical thinking style and learning styles. Gender was found to negatively moderate the impact of being a Seeker in relation to CE ($\beta = -0.013$, $p < 0.001$). Specifically, the relationship between Seeker and CE became weaker for male students when compared with female students. However, gender was not observed to act as a moderator between Engager and AE ($\beta = 0.004$, $p = 0.899$), Seeker and AE ($\beta = -0.008$, $p = 0.628$), nor Engager and RO ($\beta = 0.002$, $p = 0.724$).

Academic classification negatively moderated the impact of being a Seeker in relation to CE ($\beta = -0.014$, $p < 0.001$). The results indicate the relationship between Seeker and CE became weaker from first year students to fourth year students. Also, academic classification negatively moderated the impact of being a Seeker in relation to AE ($\beta = -0.013$, $p = 0.028$). The results indicate the relationship between Seeker and AE became weaker from first year students to fourth year students. Academic classification was not observed to act as a moderator between Engager and AE ($\beta = 0.001$, $p = 0.928$), nor Engager and RO ($\beta = 0.007$, $p = 0.173$).

Conclusion, Discussion, & Implications

Our study provides an empirical examination of the relationship between Nepalese students' learning styles and critical thinking styles, focusing on how these relationships may vary by gender and academic classification. First, we found that female and male students have different critical thinking style but not necessarily learning styles. Female students tend to have stronger seeking critical thinking style preferences, while male students are more likely to be engagers. Our study aligns with previous studies. For example, Lu et al. (2019) found that the majority of male students are engagers, and female students are seekers among Chinese and U.S. undergraduate students. Accordingly, seekers tend to be more open to others' perspectives and actively seek information or learning resources through doing research or reading. Additionally, they seek out information to enhance their knowledge (Lamm & Irani, 2011; Lamm, 2015). In contrast, for engagers, verbal communication and conversations are the preferred methods for gathering information (Lamm, 2015; Lu et al., 2021). The statistically significant gender differences in critical thinking styles suggests female students may benefit more from educational strategies that encourage information seeking, whereas male students might benefit from learning environments that encourage engagement and discussion.

Our findings also indicated that academic classification significantly influenced learning styles. Specifically, first-year respondents tended to have a stronger preference for CE. To the contrary, fourth-year respondents had the lowest preference for CE. Our study is consistent with findings from Kanske et al. (2001) which also found first-year students had higher CE scores than fourth-year students. Based on Kolb's learning style, our findings indicate that first-year respondents tend to prefer the CE learning style, which involves learning through direct experience, hands-on activities, and practical engagement (Kolb, 1984;1985). First-year students might also benefit from being actively involved in real-world tasks and learning by doing (Kolb & Kolb, 2017; Passarelli & Kolb, 2012). In contrast, fourth-year respondents had the lowest preference for the CE learning style. This result suggests that as students progress through their academic years, their learning style might shift away from direct, hands-on experiences towards other styles such as RO, AC, or AE. Fourth-year students may become more inclined to learn through reflecting on experiences, conceptualizing abstract ideas, or experimenting with new approaches (Kolb & Kolb, 2017; Morris, 2020; Passarelli & Kolb, 2012).

We also found first-year students had the least preference for AE, whereas fourth-year students had the highest preference for AE. According to Kolb (1984), this result suggests first-year students may be less inclined to test new ideas, theories, and concepts through experimentation. Instead, they might rely more on direct experiences. In contrast, as student progress through their academic journey, they may become more inclined to actively test and apply new ideas and theories

through experimentation and engage more in experimental approaches to learning. This result indicates that educators may wish to design curriculum which incorporates direct and hands-on experiences for first-year students, such as labs, field trips, to increase student engagement. For fourth-year students, educators may wish to consider designing curriculum to include more opportunities for practical applications of theoretical concepts, such as case studies and real-world scenarios (Kolb & Kolb, 2017; Morris, 2020; Passarelli & Kolb, 2012).

In addition to the more descriptive results of our study, our conceptual model also integrates and analyzes the effects of the critical thinking styles on learning style. Specifically, for engagers, a significant direct effect was observed on AE and RO, but not on CE or AC. However, the negative effect between engager and RO was unexpected. As it relates to AE, the results suggest that as engager score increases so does preference for AE. However, with RO, an inverse relationship between the constructs was observed, indicating that as engager score goes up, preference for RO goes down. This finding may indicate the engager preference for external processing (Lamm & Irani, 2011) may not translate to internal dialogue and reflection. Nonsignificant relationships with CE and AC were unanticipated, but not necessarily inconsistent with engager preferences for social construction.

The seeker critical thinking style had statistically significant relationships observed with CE and AE but not RO. However, the directionality between seeker and learning style preference was again unanticipated. The inverse relationship observed between variables may be a result of an innate desire to gather information from diverse and varied sources. The results may therefore indicate the need to not only provide concrete experiences, but to first frame experiences as representative of, but not wholly subsuming, all possible known material. Framing educational content may help to mitigate the potential for cognitive disconnects amongst learners (Roberts, 2006).

Our findings align with, and add additional empirical support for previous studies (Ghazivakili et al., 2014; Kamran et al., 2022; Shirazi & Heidari, 2019), which found that students with different critical thinking have significantly different learning styles. Additionally, critical thinking style and learning style preferences are related with each other. However, our study provides an empirical examination of the nature, magnitude, and directionality of such a relationship which is currently missing from the literature. From a practical perspective, the results of our study would imply educators in Nepal should consider using diverse educational informed by a range of learner characteristics, including not only demographic considerations such as gender or academic year, but also learner critical thinking style (Ghazivakili, et al., 2014; Kamran et al., 2022; Shirazi & Heidari, 2019).

More specifically, our study indicated gender acts as a negative moderator between the seeker critical thinking style and the CE learning stage. The effect of being a seeker on CE is less noticeable in male students compared to female students. This result implies the relationship between seeker style and CE learning style is weaker among male students. This may suggest male students who identify as seekers may not involve as actively in experiential learning as their female counterparts. As a general limitation with the study, but demonstrated in the above observation, the power of the study should be noted and considered when interpreting results. Although data were collected from a diverse sample, the population was limited to only those students available and volunteering to participate at a single university. Therefore the interpretation of the data should be limited to the existing dataset with all associated implications and recommendations framed accordingly. Nevertheless, previous studies have identified the role of gender on learning styles and critical thinking, a finding consistent with our results. For instance, Taneja et al. (2022) found significant differences between males and females in their RO, AC, and AE learning styles. Similarly, Can (2009) found students' gender can be a factor in determining their learning styles. However, to our best knowledge, there is no study that explored the moderator effect of gender between critical thinking style and learning styles. Accordingly, we recommend that future studies continue to investigate the moderating role of gender in different study settings increasing the diversity and power of subsequent analyses.

Our study also found that academic classification negatively moderates the relationship between seeker critical thinking style and CE learning style. Specifically, the effect of being a seeker on CE reduces as student growth from their first year to their fourth year. Among first-year students, the seeker style has a stronger influence on CE, suggesting that these students are more likely to prefer hands-on, experiential learning as they actively seek information. This suggests students later in their academic journey may prefer alternative learning styles, such as RO or AC. In addition, our study found amongst first-year students, the relationship between the seeker style and AE is larger in absolute terms than the relationship with CE. This finding suggests as seeker style increases, preference for AE decreases. An associated recommendation would be for agricultural educators to frame AE learning as opportunities to gather data and inform decision making, therefore framing the educational interventions within more general seeker critical thinking preferences (Lamm & Irani, 2011).

In conclusion, using Kolb's experiential learning theory and the critical thinking style, we aimed to develop a new conceptual model for improving students' educational engagement using both critical thinking style and learning styles preferences within a Nepalese context. The new critical thinking style effect on learning style conceptual model now needs to be tested to see if the inverse

relationships we uncovered hold true across agricultural students' interests, backgrounds, and circumstances including cultural norms, economic opportunities, and access to resources given they have been found to vary previously (Mukembo et al., 2023; Myers & Dyer, 2006). Continued creation and testing of innovative conceptual frameworks are needed so agricultural educators can create more inclusive and effective learning environments that meet the diverse needs of students, with the potential to enhance learner academic performance, further ensuring a strong future agricultural workforce around the globe.

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