

Futures thinking framework: relevance to veterinary students

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ABSTRACT

The futures thinking framework (FTF) is increasingly recognized as an educational approach that helps learners anticipate change and prepare for long-term challenges, but evidence from Philippine veterinary education remains limited. This cross-sectional study examined how selected Filipino veterinary students perceived the relevance of FTF to career preparedness, organizational learning, and professional adaptability. Following an introductory lecture at the 2024 National Congress of Veterinary Medicine Students, an online survey was administered that included demographic items, 18 five-point perception statements (Cronbach's α : 0.95), and three open-ended questions. Of 204 responses from 12 veterinary schools, 195 were retained after data cleaning. Data were analyzed using descriptive statistics, Kruskal-Wallis tests, exploratory factor analysis (EFA), internal consistency analysis, and thematic analysis. Most respondents were female (61.5%) and in the 5th–6th year (51.8%). The mean perception score was 4.04/5.00, indicating generally favorable views, particularly regarding eagerness to learn more about FTF and the relevance of student organizations to future professional life. After Bonferroni adjustment, only school differences in perceived administrative support for national organization activities remained significant ($p=0.0012$). The EFA identified three related domains with good-to-excellent reliability ($\alpha=0.833–0.939$). Qualitative findings revealed concerns about educator/workforce and resource gaps, and organizational suggestions emphasizing planning and mentorship.

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1. INTRODUCTION

Veterinary medicine is constantly adapting to workforce shifts, one health demands, climate-linked disease dynamics, digital technologies, and rising expectations for animal welfare, public health, and professional accountability. Veterinary foresight initiatives have argued that schools should not prepare students only for present-day practice, but also for emerging roles and uncertainties that will shape the profession over time [1], [2]. Within this context, the futures thinking framework (FTF) offers a useful

educational lens, as it helps learners connect present actions to longer-term professional, institutional, and societal consequences [3]–[5].

In this study, the FTF is posited as a futures-literacy orientation that develops anticipatory thinking, systems thinking, scenario exploration, long-term reflection, strategic planning, and transdisciplinary or one health awareness [3]–[5]. Rather than predicting a single future, the framework encourages learners to examine multiple plausible futures, reflect on values and trade-offs, and identify actions that can help shape preferred outcomes [3], [6]. These capacities are directly relevant to long-term professional success in veterinary medicine because they strengthen adaptability, strategic career planning, and resilience in a field marked by uncertainty, complex stakeholder demands, and rapidly changing knowledge environments [7]–[10].

Current veterinary education is being reshaped by several overlapping trends and challenges, including calls for one health-oriented curricula, pressure to improve workplace preparedness, rapid technological change in teaching and practice, and growing attention to sustainability, ethics, and future professional roles [1], [2], [8]–[14]. Recent initiatives have likewise emphasized curriculum harmonization, competency-based preparedness, and more forward-looking instructional design so that students can respond to climate-related risks, public-health threats, digital transformation, and non-traditional career pathways [11], [12], [14]–[18]. These developments highlight futures literacy as a practical means of preparing students to navigate complexity and lead change, and not an abstract add-on in veterinary education.

Student organizations are also important sites for futures-oriented learning. They provide opportunities for leadership, teamwork, networking, mentoring, and experiential learning, while also helping students build systems awareness, collective agency, and future-oriented career exploration [19]–[24]. In the veterinary field, local and national student organizations can therefore function as practical platforms for discussing emerging industry issues, testing ideas, and broadening students' awareness of both conventional and non-conventional professional pathways.

Despite the recognized importance of futures literacy, there is limited empirical data on how veterinary students perceive and engage with these concepts. Understanding these perceptions is valuable because curriculum designers, policymakers, and student organizations need local evidence when deciding how to introduce futures-oriented content, allocate support, and design programs that are realistic for resource-diverse institutions. The Philippine setting is especially informative because veterinary training is delivered across schools with varying institutional capacities. Moreover, their respective student organizations often serve as a major bridge between formal instruction, professional identity formation, and national-level engagement [11]–[18].

This study is novel because it provides one of the first empirical examinations of FTF perceptions among Filipino veterinary students and links futures literacy with student organization relevance, institutional support, and professional preparedness in a Philippine veterinary education context [1]–[18]. Unlike prior futures-oriented higher education and veterinary education studies that have focused mainly on broad futures literacy, faculty development, preparedness, curriculum reform, or workplace readiness, this study situates futures thinking within veterinary education, one health-oriented professional formation, and co-curricular student organization engagement [6]–[14], [19]–[24]. The findings therefore offer baseline evidence for designing future-ready veterinary curricula, faculty development initiatives, and student organization programs in resource-diverse veterinary schools [11]–[24].

This study examined how Filipino veterinary students perceived the FTF and its relevance to their academic preparation, future careers, and participation in student organizations. Specifically, it sought to:

- Describe the profile of respondents
- Assess student perceptions of FTF and its organizational relevance
- Identify themes emerging from open-ended responses
- Explore associations between selected profile variables and perception statements

By clarifying how students interpret future readiness in veterinary education, the study offers baseline evidence that may inform curriculum enhancement, faculty development, student organization programming, and later policy discussions on future-ready veterinary training.

The conceptual rationale proposes that anticipatory, systems, scenario, long-term, strategic, and transdisciplinary or one health thinking may contribute to stronger career readiness, greater perceived relevance of student organizations, and better professional adaptability and resilience, as shown in Figure 1. This structure emphasizes that futures thinking is treated as a set of related educational capacities rather than a single predictive skill. It also clarifies how individual, organizational, and institutional dimensions are connected in the study.

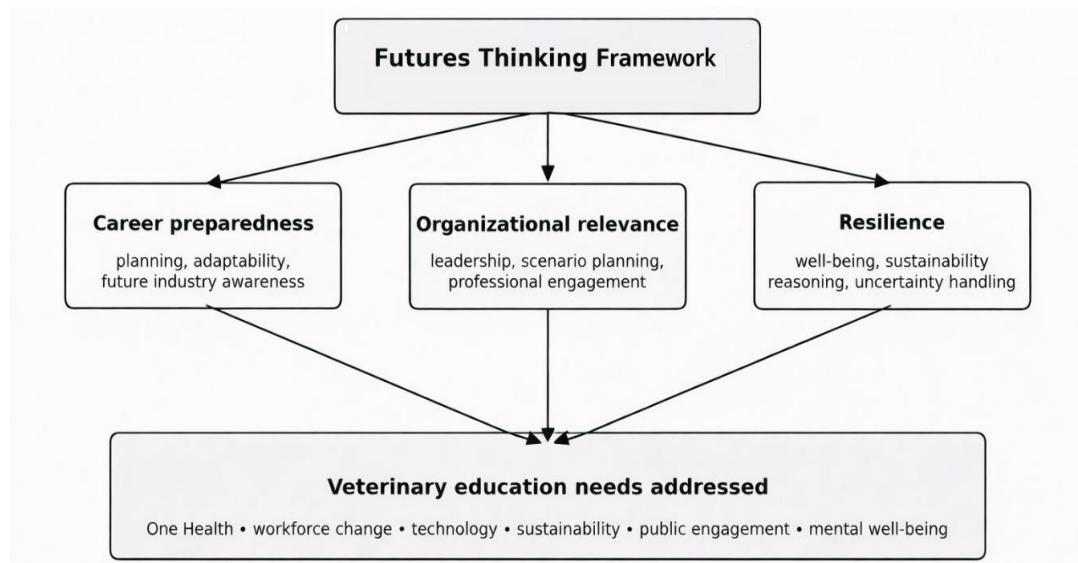


Figure 1. Conceptual framework linking FTF inputs to anticipated outcomes in veterinary education

2. METHOD

2.1. Research design

In this study, a cross-sectional descriptive-analytical design was employed, using an online survey during the 2024 National Congress of Veterinary Medicine Students in the Philippines. Perception items were assessed using an ordinal Likert scale. The subsequent analyses involved descriptive summaries and nonparametric exploratory testing.

2.2. Sampling and data collection

A total of 204 veterinary students from 12 veterinary schools in the Philippines participated in the study. After data cleaning, only 195 valid responses were retained for analysis. Participants were recruited through convenience and snowball procedures during the 2024 National Congress of Veterinary Medicine Students, after an introductory lecture on future trends in veterinary practice, sustainability, innovation, and the role of student organizations. The online survey link was shared with eligible attendees who voluntarily consented to participate. Because recruitment occurred in a congress setting rather than through a probability-based school sampling frame, the dataset is best interpreted as a multi-school congress sample rather than a nationally representative sample of Filipino veterinary students.

2.3. Operationalization and survey instrument

FTF was operationalized in this study as a set of educational ideas centered on six interrelated components: anticipatory thinking, systems thinking, scenario exploration, long-term reflection, strategic planning, and transdisciplinary or one health orientation [3]–[5]. The 18 perception statements were developed using a theory-guided approach anchored in these six components, where each item reflected one or more dimensions of futures literacy relevant to veterinary education [1]–[6]. Rather than measuring mastery of a formal stand-alone curriculum, the instrument assessed students' perceived familiarity with FTF, perceived future preparedness, perceived organizational relevance, strategic orientation, sustainability awareness, and perceived institutional support.

The questionnaire contained three sections: i) demographic items; ii) 18 five-point Likert-scale perception statements; and iii) three open-ended prompts on priority concerns, organizational improvement, and desired future activities. The draft items underwent face and content validation by three experts who reviewed them for clarity, relevance, and contextual fit, resulting in a content validity index (CVI) of 1.00. A separate pilot test involving 25 veterinary students was then conducted to assess item clarity, comprehensibility, and preliminary psychometric performance. During the pilot phase, Cronbach's alpha was computed to evaluate the internal consistency of the 18-item scale ($\alpha=0.95$). Principal component analysis (PCA) was additionally performed as an initial dimensionality check. Because of the small pilot sample size, the PCA was treated as a preliminary screening step to support item refinement and overall score coherence rather than a detailed component interpretation. The full survey dataset was subsequently used for the more robust exploratory factor analysis (EFA) and domain-level reliability assessment [25].

2.4. Statistical, psychometric, and qualitative analyses

Descriptive statistics were used to summarize respondent characteristics and Likert-scale responses. Weighted means and standard deviations were computed for descriptive purposes, and an overall perception score was calculated as the respondent-level mean across the 18 items. Kruskal-Wallis tests were used to examine associations between selected profile variables and each of the 18 perception statements. School analyses used 12 coded school categories ($n=195$), reported gender at birth analyses compared female and male respondents only using the coded gender variable ($n=176$), and year-level analyses used three grouped categories: 1st-2nd year, 3rd-4th year, and 5th-6th year ($n=195$). Because 18 item-wise tests were performed within each variable family, a Bonferroni-adjusted threshold of $p<0.0028$ was used for family-wise interpretation. Effect sizes were estimated using epsilon-squared (ϵ^2), and Dunn's post hoc pairwise comparisons with the Holm adjustment were conducted only for school effects that remained significant after Bonferroni correction.

During the separate pilot phase, Cronbach's alpha was used to examine initial internal consistency, and PCA was applied to the 18-item instrument as a preliminary dimensionality check. After the full survey was completed, the latent structure of the 18 perception items was examined more meaningfully through an EFA using principal axis factoring on the inter-item correlation matrix. Sampling adequacy was assessed using the Kaiser-Meyer-Olkin (KMO) statistic and Bartlett's test of sphericity. Because the underlying dimensions were expected to be related rather than orthogonal, Promax rotation with Kaiser normalization was applied. Factor retention was guided primarily by the Kaiser criterion (eigenvalues >1), the interpretability of the rotated solution, and the coherence of item content. Cronbach's alpha was then computed for the EFA-guided domains. For domain-level alpha estimation, the cleaner primary-loading items were grouped under each factor, whereas the cross-loading items S10 and S14 were retained in full-scale descriptive reporting but excluded from domain alpha computation because of their conceptual overlap across factors. To evaluate whether the 18-item instrument could be represented by a single latent construct, a one-factor confirmatory factor analysis (CFA) was conducted using diagonally weighted least squares (DWLS). Because the one-factor model fit poorly, an additional EFA-informed 16-item three-factor structural equation modeling (SEM)/CFA model was explored as a provisional follow-up. However, this supplementary model generated estimation warnings and was interpreted cautiously as preliminary rather than confirmatory evidence.

The responses in the three open-ended questions were analyzed using a mixed inductive-deductive thematic approach informed by reflexive thematic analysis [26]. Two primary coders independently reviewed the first 30 responses to develop an initial, question-specific codebook for each prompt, then applied the evolving codebook to the remaining responses, adding new themes whenever conceptually important patterns emerged. Because themes were non-mutually exclusive, a respondent could contribute to more than one theme within a given question. Inter-coder reliability was calculated from the two primary coders only using pooled Cohen's kappa across binary theme assignments, and agreement was moderate (pooled Cohen's $\kappa=0.46$; raw agreement=91.9%). Cases of disagreement were subsequently reviewed by a third coder, who acted as adjudicator to resolve discrepancies and produce the final reconciled coding used for the question-specific theme frequencies.

2.5. Ethical considerations

The study complied with the ethical principles outlined in the Helsinki Declaration and the relevant Philippine research ethics guidelines. Participation was voluntary, with informed consent obtained from all respondents. Responses were anonymized before analysis, and quotations were reported without personal identifiers to ensure confidentiality. The Local Research Ethics Committee of Cebu Technological University–Daanbantayan granted ethical approval.

3. RESULTS AND DISCUSSION

3.1. Respondent profile

Most respondents were female (61.5%) and were in the 5th-6th year group (51.8%), as shown in Table 1. The higher proportion of senior students may reflect the stronger congress participation of learners who were already more engaged in clinical exposure, leadership activities, and immediate career planning [7]–[10]. This composition is relevant because questions about future professional roles, organizational relevance, and preparedness may be especially salient to students nearing graduation [8]–[10].

All 12 coded schools were represented, but one institution contributed 44.1%. While this broad institutional spread is useful for capturing perspectives from multiple schools, the heavy weighting can make descriptive patterns partly reflect the culture, resources, and organizational environment of that institution [15]–[18]. The findings are therefore best interpreted as congress-based perceptions from a multi-school convenience sample rather than as population estimates for all veterinary schools in the Philippines.

Table 1. Profile of veterinary student respondents (n=195)

Variable	Category	Freq	%
Gender	Female	120	61.5
	Male	56	28.7
	Preferred not to indicate	19	9.7
Year level	1st-2nd	31	15.9
	3rd-4th	63	32.3
	5th-6th	101	51.8
School	A	9	4.6
	B	4	2.1
	C	37	19.0
	D	11	5.6
	E	6	3.1
	F	6	3.1
	G	7	3.6
	H	4	2.1
	I	5	2.6
	J	86	44.1
	K	6	3.1
	L	14	7.2

3.2. Exploratory factor structure and internal consistency

Following theory-guided item development, expert validation, and pilot testing, in which PCA was used as a preliminary dimensionality check, the full survey dataset was subjected to an EFA to examine the latent structure more robustly, as shown in Table 2. The KMO measure was 0.927, and Bartlett's test of sphericity was significant, Chi-square or $\chi^2(153)=2895.09$, $p<0.001$, indicating that the inter-item correlations were appropriate for factor extraction. Using principal axis factoring with Promax rotation, three factors with eigenvalues greater than 1 were retained. The initial eigenvalues of the first three factors were 10.00, 1.52, and 1.15, and the extracted three-factor solution accounted for 64.74% of the cumulative variance. The earlier pilot-stage PCA was used only to screen dimensional concentration and item coherence, whereas the present EFA provided the main exploratory evidence regarding the instrument's latent structure. Taken together, these results suggest that the scale reflects an interpretable, futures-oriented perception structure rather than a random aggregation of attitude items, consistent with the broader literature on futures literacy and professional preparedness in higher education [3]–[5], [7]–[10], [27].

Table 2. EFA summary and internal consistency of EFA-guided domains (n=195)

Domain	Representative item codes	No. of items used for alpha	Cronbach's α
Organizational/professional futures relevance	S2, S3, S4, S11, S12, S13, S15, S16	8	0.939
Institutional/instructional support for future readiness	S8, S9, S17, S18	4	0.884
Personal futures awareness/self-directed industry orientation	S1, S5, S6, S7	4	0.833

Note: EFA used principal axis factoring with Promax rotation. Overall sampling adequacy was high (KMO=0.927), and Bartlett's test of sphericity was significant, $\chi^2(153)=2895.09$, $p<0.001$. Three factors were retained using the eigenvalue-greater-than-1 criterion, and the extracted solution accounted for 64.74% of the cumulative variance. Domain-level alpha estimates were based on the cleaner primary-loading items; cross-loading items S10 and S14 were interpreted as bridge items and were not included in the subscale alpha computation.

The first factor captured organizational and professional futures relevance, with strong primary loadings for eagerness to learn more about FTF (S2), the professional relevance of local and national student organizations (S3-S4), the relevance of national and local organization programs to future community or industry needs (especially S11-S13), and awareness of the purpose of local and national organizations (S15-S16). This pattern is consistent with literature describing student organizations as sites for mentoring, experiential learning, collective agency, and career exploration [19]–[24]. The second factor reflected institutional and instructional support for future readiness, defined mainly by professor or instructor currency and preparation (S8-S9) and school support for local and national organization activities (S17-S18), which aligns with work emphasizing curriculum preparedness, faculty capability, and organizational support in veterinary and higher education settings [8]–[12], [15]–[18]. The third factor represented personal futures awareness and self-directed industry orientation, anchored by familiarity with FTF (S1), awareness of future industry trends and sustainability (S5-S6), and efforts to stay up to date on research, innovation, and technology (S7), echoing studies linking futures-oriented learning with systems thinking, agency, and openness to future possibilities [4], [5], [27]–[30].

Some items displayed conceptual overlap across domains. S10 and S14 showed meaningful cross-loadings and were therefore interpreted cautiously as bridge items connecting organizational relevance and institutional support. Nonetheless, the overall pattern was coherent enough to justify provisional domain interpretation. Internal consistency of the EFA-guided domains was also strong: $\alpha=0.939$ for organizational/professional futures relevance, $\alpha=0.884$ for institutional/instructional support, and $\alpha=0.833$ for personal futures awareness/self-directed industry orientation. These results provide initial support for score coherence at both the total-scale and exploratory domain levels [25].

The factor pattern suggests that veterinary students did not view futures thinking as a single, abstract idea. Instead, they perceived it at three linked domains: personal awareness of future trends and innovation, the professional relevance of student organizations, and the degree to which faculty members and school administrations support future-oriented preparation. This structure is substantively meaningful because long-term professional success in veterinary medicine depends not only on individual adaptability but also on the organizational and institutional environments that shape students' opportunities for engagement and career exploration [7]–[10], [19]–[24]. Hence, the psychometric pattern supports the study's broader argument that futures literacy in veterinary education is simultaneously individual, collective, and structural [3]–[5], [15]–[18].

3.3. CFA and model evaluation

To examine whether the full 18-item instrument could be treated as strictly unidimensional, a one-factor CFA was estimated using DWLS. The model showed poor fit, $\chi^2(135)=902.42$, $p<0.001$, with comparative fit index (CFI)=0.759, Tucker–Lewis index (TLI)=0.727, root mean square error of approximation (RMSEA)=0.171, and standardized root mean square residual (SRMR)=0.149. These indices indicate that a single latent factor did not adequately reproduce the observed response pattern. Although many items loaded significantly on the common factor, several indicators were weak or unstable, particularly S3, S7, and S13, and S7 was non-significant in the initial one-factor output. The findings therefore did not support the strict unidimensionality of the 18-item perception scale, suggesting that futures-oriented perceptions in veterinary education are better understood as multidimensional and context-linked rather than as a single homogeneous disposition [3]–[5], [7]–[10].

Because the EFA identified three related domains, an EFA-informed 16-item three-factor SEM/CFA model was subsequently explored after removing the weaker cross-loading items, S10 and S14. In this provisional model, the institutional/instructional support factor showed comparatively coherent loadings. In contrast, the organizational/professional futures relevance and personal futures awareness factors still displayed unstable or oppositely signed loadings, and the estimation produced warnings. Accordingly, the confirmatory analyses were interpreted as preliminary and non-supportive of definitive structural confirmation. At this stage, the psychometric evidence is stronger for exploratory domain identification via EFA than for confirmatory validation of a stable latent measurement model, consistent with the need for iterative refinement in new futures-oriented educational instruments [4], [5], [25], [27].

3.4. Key perceptions of futures thinking and organizational relevance

Overall, respondents showed a favorable view of FTF and of the relevance of student organizations to future professional life, with a mean perception score of 4.04/5.00 across the 18 items, as shown in Tables 3 and 4. This pattern is consistent with higher education studies showing that futures-oriented learning tends to strengthen systems thinking, agency, openness to alternatives, and readiness for uncertain environments [4], [5], [27]–[30]. In veterinary education, these qualities matter because long-term professional success increasingly depends not only on technical competence, but also on adaptability, reflective judgment, and the ability to respond to emerging societal and industry demands [7]–[10]. For statement 1, however, only 60.0% agreed or strongly agreed that they were familiar with FTF, while 28.7% were neutral. This sizeable neutral block suggests partial or early-stage understanding rather than deep conceptual familiarity [3]–[6].

Interest in further learning was notably strong: 86.7% agreed or strongly agreed that they were eager to learn more about FTF. Students likewise perceived substantial relevance in the activities of both local and national veterinary student organizations, with 82.6% and 87.2%, respectively, agreeing or strongly agreeing that these activities were relevant to their future profession and industry. Taken together, these findings suggest that students do not regard futures thinking as a purely abstract concept; instead, they appear ready to encounter it through practical forums such as mentoring, case discussions, advocacy activities, leadership work, and career-exploration events [19]–[24]. Such settings may help translate futures literacy into professional adaptability and career resilience by allowing students to test ideas, imagine options, and connect present training with future roles [3]–[5], [22]–[24].

Students also generally expressed positive perceptions of industry awareness and faculty preparation, although some uncertainty remained. While 71.3% agreed or strongly agreed that they were familiar with trends in their future industry, 22.6% were neutral. Similarly, 78.5% believed that their

professors or instructors had updated knowledge, and 77.4% felt that their professors were preparing them well for their intended future industry. These patterns suggest cautious confidence in faculty guidance alongside room to strengthen consistency across schools, which aligns with veterinary education literature emphasizing preparedness, exposure to contemporary practice issues, and forward-looking curriculum design [8]–[12].

One of the most informative findings concerns sustainability. Although 69.7% agreed or strongly agreed that current industry practices are sustainable, 25.6% selected the neutral option. This hesitation may reflect the conceptual breadth of sustainability in veterinary education, which can encompass environmental stewardship, public health protection, antimicrobial stewardship, animal welfare, ethical practice, and the long-term viability of veterinary careers [13], [14], [31]. Neutral responses in this context may therefore signal uncertainty about how to integrate these dimensions rather than simple indifference, especially after only brief exposure to futures-oriented concepts [3]–[5].

Perceptions of administrative support for student organizations were generally positive, but weaker than those for many items related to professional relevance. Agreement levels reached 65.1% for local organization support and 71.8% for national organization support, and both items also drew relatively high neutral responses. This pattern indicates that students value organizations as developmental spaces, but do not uniformly experience strong institutional support for them. That point matters because futures-oriented co-curricular learning is more likely to be sustained when schools treat student organizations as legitimate learning environments rather than as optional extracurricular add-ons [15]–[21]. The administrative support and other key perception indicators are shown with their corresponding neutral responses, agreement levels, means, standard deviations, and brief interpretations, as shown in Table 3. The item-level distribution of strongly disagree, disagree, neutral, agree, and strongly agree responses for all 18 statements is reported immediately after the key perception summary, as shown in Table 4.

Table 3. Summary of key student perceptions related to the FTF (n=195)

Statement topic	Agree/strongly agree (%)	Neutral (%)	Mean±SD	Key interpretation
Familiarity with FTF	60.0	28.7	3.66±0.98	Partial understanding after the lecture.
Eagerness to learn more about FTF	86.7	9.7	4.29±0.81	Strong interest in further learning.
Local organization activities relevant to a future profession	82.6	13.3	4.15±0.88	Local organization seen as a professional space.
National organization activities relevant to the future profession	87.2	10.8	4.37±0.78	National organization perceived as highly relevant.
Familiarity with future industry trends	71.3	22.6	3.88±0.90	Moderate confidence with room to improve.
Current industry practices are sustainable	69.7	25.6	3.91±0.85	Substantial uncertainty about sustainability.
Professors have updated knowledge	78.5	17.4	4.05±0.86	General confidence in faculty knowledge.
Professors prepare students for the future industry	77.4	19.0	4.06±0.87	Faculty preparation is generally positive.
School supports local student organization activities	65.1	27.7	3.82±0.99	Support is visible but uneven.
School supports national student organization activities	71.8	18.5	3.96±1.05	Stronger support for the national body.

Note: higher mean values indicate stronger perceived relevance of futures thinking and organization-related activities.

3.5. Emerging qualitative themes

For futures concerns and challenges in veterinary education and practice, the most frequent theme was educator/workforce and resource gaps (41/195, 21.0%). This was followed by public awareness, illegal practice, and other professional issues (31/195, 15.9%) and antimicrobial resistance (AMR), zoonoses, emerging disease, and public health concerns (25/195, 12.8%). Themes related to wildlife, sustainability, climate, one health, and animal welfare, as well as access to care, were each mentioned by 18 respondents (9.2%). Smaller but still notable concerns included practical skill preparedness (8/195, 4.1%) and mental health or burnout (7/195, 3.6%), as shown in Table 5. These patterns suggest that students framed future readiness not only in terms of individual competence, but also in relation to broader workforce, institutional, and societal constraints affecting veterinary practice [7]–[14], [31].

For suggestions to improve student organizations, the dominant theme was time management, scheduling, and logistics (32/195, 16.4%). This indicates that students were particularly concerned with how organizational activities are planned and delivered. The next most common themes were mentorship and stronger links with professional organizations (16/195, 8.2%) and scope diversification or more relevant learning opportunities (16/195, 8.2%). Less frequent but still meaningful suggestions included accessibility,

communication, and inclusivity (7/195, 3.6%), community advocacy or outreach (5/195, 2.6%), financial accessibility or budget concerns (4/195, 2.1%), student welfare and engagement (4/195, 2.1%), and facilities or equipment (2/195, 1.0%), as shown in Table 5. Overall, these responses show that students viewed organizations as potentially important developmental spaces, but expected them to be more structured, accessible, and professionally relevant [19]–[24].

Table 4. Detailed distribution of student perceptions about the FTF and its relevance to student organization and future career (n=195)

Statement	SD n (%)	D n (%)	N n (%)	A n (%)	SA n (%)	Mean±SD
I am familiar with the futures thinking framework.	5 (2.6)	17 (8.7)	56 (28.7)	78 (40.0)	39 (20.0)	3.66±0.98
I am eager to learn more about the futures thinking framework.	1 (0.5)	6 (3.1)	19 (9.7)	78 (40.0)	91 (46.7)	4.29±0.81
The majority of my local student organization's activities are relevant to my future profession and industry.	4 (2.1)	4 (2.1)	26 (13.3)	86 (44.1)	75 (38.5)	4.15±0.88
The majority of the activities of the national veterinary student organization are relevant to my future profession and industry.	1 (0.5)	3 (1.5)	21 (10.8)	68 (34.9)	102 (52.3)	4.37±0.78
I am familiar with the trends of my future industry.	4 (2.1)	8 (4.1)	44 (22.6)	91 (46.7)	48 (24.6)	3.88±0.90
The current practices in my future industry are sustainable.	1 (0.5)	8 (4.1)	50 (25.6)	85 (43.6)	51 (26.2)	3.91±0.85
I keep myself updated on the latest research, innovations, and technological developments in my field of interest or in future industries.	2 (1.0)	10 (5.1)	51 (26.2)	90 (46.2)	42 (21.5)	3.82±0.86
My professors or instructors have updated knowledge on the latest research, innovations, and technological developments in my field of interest or future industry.	3 (1.5)	5 (2.6)	34 (17.4)	91 (46.7)	62 (31.8)	4.05±0.86
My professors or instructors are preparing me well for the future industry I want to be involved in.	3 (1.5)	4 (2.1)	37 (19.0)	85 (43.6)	66 (33.8)	4.06±0.87
The programs of my local student organization are relevant to the community's future needs, given the industry I would be in.	1 (0.5)	6 (3.1)	40 (20.5)	88 (45.1)	60 (30.8)	4.03±0.83
The programs of the national student organization are relevant to the community's future needs, given the industry I would be in.	1 (0.5)	2 (1.0)	24 (12.3)	86 (44.1)	82 (42.1)	4.26±0.75
The programs of my local student organization are relevant to the needs and trends of my future industry.	1 (0.5)	9 (4.6)	40 (20.5)	88 (45.1)	57 (29.2)	3.98±0.86
The programs of the national student organization are relevant to the needs and trends of my future industry.	2 (1.0)	2 (1.0)	26 (13.3)	83 (42.6)	82 (42.1)	4.24±0.80
My local student organization conducts appropriate strategic planning.	2 (1.0)	4 (2.1)	51 (26.2)	82 (42.1)	56 (28.7)	3.95±0.85
I know the real purpose of my local student organization.	2 (1.0)	4 (2.1)	35 (17.9)	84 (43.1)	70 (35.9)	4.11±0.84
I know the real purpose of the national student organization.	2 (1.0)	4 (2.1)	26 (13.3)	74 (37.9)	89 (45.6)	4.25±0.84
Our school administration supports the activities of my local student organization.	7 (3.6)	7 (3.6)	54 (27.7)	74 (37.9)	53 (27.2)	3.82±0.99
Our school administration supports the activities of the national veterinary student organization.	6 (3.1)	13 (6.7)	36 (18.5)	68 (34.9)	72 (36.9)	3.96±1.05

Note: percentages are row percentages computed using n=195 and may not total exactly 100.0 because of rounding.

SD=strongly disagree; D=disagree; N=neutral; A=agree; SA=strongly agree. Mean scores were computed on a 1–5 scale.

Regarding desired future activities, the strongest theme by far was hands-on training, surgery, and laboratory activities (59/195, 30.3%). This was followed by field exposure, outreach, and missions (20/195, 10.3%), soft skills, career guidance, thesis support, and networking (19/195, 9.7%), and specialization, non-traditional career tracks, and global seminars (13/195, 6.7%). Only a few respondents explicitly mentioned public health, one health, AMR, and emerging disease activities (3/195, 1.5%), mental health and wellness activities (3/195, 1.5%), or technology and equipment-focused activities (2/195, 1.0%), as shown in Table 5. These findings suggest that when students were asked what they wanted organizations to do in the future, they prioritized concrete experiential learning opportunities over abstract discussion, which aligns with calls for workplace preparedness, exposure-based learning, and broader career development in veterinary education [8]–[12], [22]–[24].

The question-specific themes clarify several patterns seen in the Likert-scale results. The favorable ratings for organization-related items are consistent with the qualitative evidence showing that students expect organizations to provide mentorship, practical learning, and career-linked activities [19]–[24]. On the other hand, the neutral responses on FTF familiarity and sustainability may reflect partial exposure to concepts that students still translate into concrete concerns, such as resource gaps, public health threats, or

non-traditional career possibilities [3]–[5], [13], [14], [31]. Finally, the strong interest in hands-on training and field exposure reinforces the idea that futures-oriented learning is most meaningful to students when it is connected to practical preparation, organizational relevance, and visible career pathways [7]–[10], [22]–[24].

Table 5. Question-specific qualitative themes identified from the three open-ended responses (n=195)

Area	Theme	n	%
Futures concerns/challenges	Educator/workforce and resource gaps	41	21.0
	Public awareness/illegal practice/professional issues	31	15.9
	AMR/zoonoses/emerging disease/public health	25	12.8
	Wildlife/sustainability/climate/one health	18	9.2
	Animal welfare/access to care	18	9.2
	Practical skill preparedness	8	4.1
	Mental health/burnout	7	3.6
Suggestions for organization improvement	Time management/scheduling/logistics	32	16.4
	Mentorship/professional organizations	16	8.2
	Scope diversification/relevant learning	16	8.2
	Accessibility/communication/inclusivity	7	3.6
	Community advocacy/outreach	5	2.6
	Financial accessibility/budget	4	2.1
	Student welfare/engagement	4	2.1
	Facilities/equipment	2	1.0
Suggested future activities	Hands-on training/surgery/labs	59	30.3
	Field exposure/outreach/missions	20	10.3
	Soft skills/career guidance/thesis/networking	19	9.7
	Specialization/non-traditional/global seminars	13	6.7
	Public health/one health/AMR/emerging disease	3	1.5
	Mental health/wellness	3	1.5
	Technology/equipment	2	1.0

Note: counts are descriptive and non-mutually exclusive within each question.

3.6. Inferential results and limitations

Analysis revealed only one omnibus association that remained statistically significant: school and students' perception that the school administration was supportive of the activities of the national veterinary student organization (S18: $H=30.81$, $df=11$, $p=0.0012$, $\varepsilon^2=0.108$). By conventional benchmarks, this effect approaches the moderate-to-large range, indicating that institutional context meaningfully shaped students' experience of organizational support. Dunn's post hoc comparisons with the Holm adjustment indicated that School A had significantly lower ratings than Schools D, F, J, and L. Substantively, this suggests that the organizational relevance of futures thinking is partly mediated by how schools enable participation, continuity, and legitimacy for student-led activities [19]–[21]. This interpretation is also consistent with broader futures and higher education literature, which emphasizes that strategic support, institutional culture, and organizational design influence whether future-oriented initiatives can be sustained [6], [15]–[18].

Four additional school-level associations were nominally significant but did not survive the Bonferroni correction: perceived professor or instructor knowledge of updated research, innovations, and technological developments (S8), perceived professor or instructor preparation for the future industry students wanted to join (S9), perceived relevance of national organization programs to future community needs (S11), and perceived school support for local student organization activities (S17). These effects were small to modest and should be interpreted as exploratory. Even so, they point toward potentially meaningful differences in faculty preparedness and institutional support that may merit targeted faculty development, organizational review, and follow-up study in larger samples [8]–[12], [15]–[18].

In the second round of analysis, reported gender at birth showed nominal associations with three organization-related items, but none remained significant after Bonferroni adjustment. These results should therefore be treated cautiously and not as evidence of stable gender-based differences in futures thinking or organizational relevance. Given the exploratory design and the exclusion of sparse categories from inferential testing, the findings are better understood as signals for later hypothesis testing rather than as definitive subgroup conclusions, consistent with cautious interpretation in educational and preparedness research [7]–[10], [25].

Year-level differences were likewise modest. Students in the 1st-2nd year group tended to assign somewhat higher relevance scores to local organization activities, but no year-level effect remained significant after family-wise adjustment. This may mean that enthusiasm for organizational relevance is broadly shared across training stages, even if the forms of engagement and practical expectations differ [19]–[24]. Several limitations should be considered when interpreting the findings. The sample was

obtained through nonprobability recruitment at a single national congress, and one school accounted for 44.1% of the valid responses. Accordingly, the results are not intended to represent all Filipino veterinary students and may partly reflect the environment of the institution with the most students. Future studies would benefit from broader, more balanced recruitment across schools and regions, especially because institutional capacity and educational context can shape how futures-oriented initiatives are perceived and implemented [11]–[12], [15]–[18].

The timing of data collection also matters. The survey was administered immediately after an introductory lecture on FTF, which likely introduced recency effects and demand characteristics that may have elevated reported familiarity and immediate enthusiasm. For that reason, the 60.0% agreement on FTF familiarity should not be interpreted as a direct measure of prior knowledge, and the positive ratings are best read as post-exposure perceptions rather than stable long-term attitudes. The cross-sectional design likewise precludes causal interpretation of the observed associations, particularly with respect to short-term shifts in futures-oriented awareness [3]–[6], [27].

Finally, the instrument should still be interpreted as exploratory. Although the 18-item scale was developed through a theory-guided process, reviewed by three experts (CVI=1.00), pilot-tested in a separate group of 25 veterinary students, and showed excellent internal consistency with a coherent three-factor EFA solution, the confirmatory evidence remains limited. The one-factor CFA showed poor fit, indicating that the scale should not be treated as strictly unidimensional. At the same time, the EFA-informed 16-item three-factor SEM/CFA model remained unstable and produced estimation warnings. Because the pilot-stage PCA was based on a small sample, it should be interpreted only as a preliminary dimensionality screen rather than as a stable structural confirmation [25]. Similarly, while the qualitative component used two coders and showed moderate agreement, the final thematic structure remains interpretive and would benefit from continued refinement and prospective consensus procedures [26]. Next steps should therefore include refinement of weak or cross-loading items, confirmatory testing of the proposed multidimensional structure in a larger independent sample, evaluation of test-retest stability, development and piloting of futures-oriented teaching modules, and longitudinal studies examining whether repeated exposure to futures literacy influences career planning, organizational engagement, adaptability, and professional resilience over time [3]–[5], [22]–[24], [27]. The Kruskal-Wallis results with nominal or Bonferroni-significant associations are organized by profile variable, perception statement, test statistic, p-value, epsilon-squared effect size, and post hoc result where applicable, as shown in Table 6.

Table 6. Kruskal-Wallis tests examining associations between profile variables and perception statements

Variable	Statement	H	df	p-value	ϵ^2	Bonferroni-significant?	Post-hoc (Dunn-Holm)
School	S8: faculty updated knowledge	20.50	11	0.0389	0.052	No	Not applicable
School	S9: faculty preparation for the future industry	22.25	11	0.0225	0.061	No	Not applicable
School	S11: national organization relevance to the community	20.49	11	0.0391	0.052	No	Not applicable
School	S17: school supports local organization	26.36	11	0.0057	0.084	No	NA
School	S18: school supports national organization	30.81	11	0.0012	0.108	Yes	School A<D, F, J, L
Gender (female vs male)	S4: national organization relevance to profession	7.31	1	0.0069	0.036	No	Not applicable
Gender (female vs male)	S11: national organization relevance to the community	4.12	1	0.0424	0.018	No	Not applicable
Gender (female vs male)	S12: local organization relevance to industry	5.57	1	0.0182	0.026	No	Not applicable
Year level	S3: local organization relevance to profession	7.08	2	0.0291	0.026	No	Not applicable
Year level	S12: local organization relevance to industry	6.67	2	0.0356	0.024	No	Not applicable

Note: Bonferroni correction was applied within each variable family across the 18 perception items (adjusted threshold $p<0.0028$). Dunn's post hoc comparisons with the Holm adjustment were conducted only for school comparisons that met the Bonferroni-adjusted threshold. The gender analyses compared female and male respondents only ($n=176$), and year-level analyses used grouped 1st–2nd, 3rd–4th, and 5th–6th categories ($n=195$). ϵ^2 =epsilon-squared effect size (small ≥ 0.01 , moderate ≥ 0.06 , large ≥ 0.14).

4. CONCLUSION

Filipino veterinary students generally perceived futures thinking as relevant to their education, future careers, and student organization activities. EFA suggested that these perceptions were relevant to specific dimensions, including organizational and professional futures relevance, institutional and instructional support for future readiness, and personal futures awareness or self-directed industry orientation.

However, the subsequent CFA findings indicate that the present instrument should not yet be interpreted as a confirmed latent-scale structure and require additional investigation. For curriculum designers, policymakers, and student leaders in the Philippines, the study offers baseline evidence that futures literacy can be introduced through both formal teaching and co-curricular programming, with student organizations serving as practical entry points for engagement.

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AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

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C : Conceptualization

M : Methodology

So : Software

Va : Validation

Fo : Formal analysis

I : Investigation

R : Resources

D : Data Curation

O : Writing - Original Draft

E : Writing - Review & Editing

Vi : Visualization

Su : Supervision

P : Project administration

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest. No financial or personal relationship influenced the study design, analysis, interpretation, or reporting of the findings. The authors are responsible for the content and conclusions of the manuscript.

INFORMED CONSENT

Informed consent was obtained from all individuals who participated in this study. Participation was voluntary, and respondents were informed of the purpose of the survey before completing it. No personally identifying information was reported in the manuscript.

ETHICAL APPROVAL

The study adhered to relevant national regulations of the Philippine Health Research Ethics Board and institutional policies, in line with the principles of the Helsinki Declaration. The Local Research Ethics Committee of Cebu Technological University approved the study. The approval covered the anonymous survey procedures used in the study.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author, [APY], upon reasonable request. The dataset contains anonymized responses and will be shared only in accordance with ethical approval and confidentiality requirements. Requests should be directed to the corresponding author.

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