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Calibrating Expert Consensus in Delphi Studies for Developing Communication Competencies

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Abstract

Delphi studies are widely used for expert-based consensus building in education and social sciences; however, the absence of a universally accepted standard for determining consensus remains a persistent methodological challenge. Different studies employ varying statistical thresholds and decision rules, leading to inconsistencies in indicator selection and interpretation. Addressing this methodological gap, the study employed a cross-sectional, multi-phase Delphi design to develop communication competencies by applying a tailored calibrated multi-criteria Delphi framework. A panel of thirty experts participated in three iterative rounds, and consensus was established with context-specific thresholds using a combination of median values, interquartile range (IQR), quartile deviation (QD), and percentage agreement. The process resulted in the identification of 11 key communication skill indicators demonstrating high consensus (QD $\leq$ 0.5; IQR $\leq$ 1) and very high importance (Median $\geq$ 4; $\geq$ 80% agreement). To assess practical relevance, a Training Need Index (TNI) analysis was conducted among 210 postgraduate students from three leading agricultural institutions in India. The findings revealed moderate to high training needs, particularly in interactive communication competencies such as initiating discussions, persuasive communication, and voice modulation. Grounded in Social Cognitive Theory and communication competence perspectives, the study highlights the role of a structured, evidence-based framework with calibrated criteria in identifying skill gaps. The proposed calibrated consensus approach offers a transparent and replicable model for Delphi studies, with implications for strengthening communication capacity in professional education and public health-related extension systems.

Keywords: *Capacity building; communication competencies; consensus calibration; Delphi technique; higher education; Training Need Index.*

Introduction

Communication competence is increasingly recognized as a core professional requirement for graduates in higher education, particularly in disciplines where knowledge dissemination, stakeholder engagement, and behavioural influence are central. In agricultural and rural systems, professionals frequently operate at the interface of education, extension, and community engagement, where effective communication plays a key role in translating technical knowledge into actionable practices [23]. In contemporary extension systems, professionals must translate scientific knowledge into actionable information for varied audiences, making communication competence an essential component of professional effectiveness.

However, several studies have identified persistent communication skill gaps among professionals, particularly in scientific writing, oral presentation, and interpersonal communication [3]. This has direct implications not only for professional effectiveness but also for broader public health outcomes, including nutrition awareness, environmental safety, and adoption of sustainable practices.

From a theoretical perspective, communication competence can be viewed as a multidimensional construct involving cognitive, behavioural, and contextual elements of communication ability. Educational theories such as Social Cognitive Theory [2] highlight the interaction between personal capabilities, behavioural practice, and environmental influences in skill development. Similarly, Experiential Learning Theory [15] emphasizes the importance of learning through experience, reflection, and practice in developing professional competencies. Within the communication domain, Communication Competence Theory suggests that effective communication depends on the integration of knowledge, skills, and motivation necessary to perform communication tasks appropriately in different contexts [20]. These theoretical perspectives underscore the need to identify measurable indicators that reflect the multiple dimensions of communication competence among students in higher agricultural education.

The development of competency indicators in professional development research has traditionally relied on a variety of methodological approaches that combine theoretical insights with expert judgment. Literature-based indicator identification is commonly used to establish conceptual foundations; however, such approaches may overlook emerging professional expectations and contextual realities within specific disciplines. Other participatory approaches such as focus group discussions, nominal group techniques, and expert workshops allow for collaborative brainstorming and discussion among experts. While these methods can generate diverse perspectives, they often involve direct interaction among participants, which may introduce social pressures, dominance effects, and group conformity that influence individual judgments and potentially bias the outcomes of the discussion [12].

In addition, more structured decision-making approaches such as the Analytic Hierarchy Process (AHP) and other multi-criteria decision analysis techniques have been applied in indicator development and prioritization studies. These approaches are particularly useful when researchers need to assign weights to predefined indicators or rank alternatives based on multiple evaluation criteria. However, such techniques require clearly defined decision structures and evaluation frameworks, making them less suitable for exploratory contexts where indicators must first be generated, refined, and validated through expert knowledge [26]. Similarly, conventional survey-based approaches can capture expert opinions but lack the iterative feedback mechanisms necessary to facilitate the refinement and convergence of expert judgments over time.

In situations where empirical evidence is limited and expert knowledge must be systematically synthesized, the Delphi technique offers a more appropriate methodological approach. Originally developed by the RAND Corporation, the Delphi technique is defined as a structured communication process in which experts provide their judgments through multiple rounds of questionnaires with controlled feedback between rounds [18]. Unlike traditional discussion-based methods, the Delphi technique maintains anonymity among panel members, thereby reducing the influence of dominant individuals and enabling experts to express their opinions independently.

Several methodological characteristics make the Delphi technique particularly suitable for competency identification and indicator development studies. The method allows researchers to collect knowledge from geographically dispersed experts without requiring physical meetings. The iterative nature of the process enables experts to reconsider their responses after reviewing aggregated group feedback, which gradually promotes convergence of opinions [16]. Furthermore, anonymity among panel members reduces group pressure and encourages independent judgment, thereby improving the reliability of expert consensus [12]. Therefore, the Delphi method remains particularly valuable in health communication research

where expert-driven synthesis is required in the absence of definitive empirical evidence.

Within professional development contexts, Delphi studies have been widely used to identify professional competencies required for agricultural educators, extension professionals, and students. These studies demonstrate the usefulness of Delphi in synthesizing expert knowledge and developing structured competency frameworks for emerging skill domains [9]. Furthermore, recent studies have increasingly applied the Delphi technique in public health research to develop communication competency frameworks, assess risk communication strategies, and identify health literacy competencies. At the same time, methodological discussions highlight growing variability in consensus determination, emphasizing the need for more standardized and transparent approaches.

The literature indicates that there is no universally accepted criterion for defining consensus in Delphi studies [13]. Researchers have adopted various statistical measures to determine consensus, including percentage agreement, mean scores, median values, standard deviation, interquartile range (IQR), and disagreement indices [28]. Some studies define consensus based on minimum percentage agreement among respondents, while others rely on dispersion measures such as disagreement indices or standard deviation thresholds [8]. Consequently, there is considerable methodological variation in how Delphi studies determine and report consensus.

To address this methodological challenge, several scholars recommend using multiple statistical indicators simultaneously to evaluate both the importance of items and the level of agreement among experts. Measures of central tendency such as the median help determine the perceived importance of indicators, while dispersion measures such as the interquartile range (IQR) and quartile deviation provide insight into the degree of agreement among panel members. The median is particularly appropriate for analysing ordinal data because it is less sensitive to extreme values than the mean [11], while the interquartile range is widely considered a robust indicator of consensus in Delphi studies [5].

Recognizing this methodological limitation, the present study employs the Delphi technique to identify and validate communication skill indicators relevant for professional development. Since Delphi studies do not follow a universal consensus standard, the study adopts a calibrated multi-criteria consensus approach, integrating median values, interquartile range, quartile deviation, and percentage agreement to determine both the importance of indicators and the level of expert consensus. Thus, beyond identifying communication indicators, the study contributes methodologically by proposing a calibrated multi-criteria consensus framework for Delphi-based indicator development.

Objectives of the Study

In view of the communication skill gaps observed among postgraduate agricultural students and the absence of a universally accepted criterion for determining consensus in Delphi studies, the present study aims to develop and validate communication skill indicators relevant to higher agricultural education. Specifically, the study seeks to achieve the following objectives:

1. To identify and develop communication competency indicators using a structured Delphi technique.
2. To establish expert consensus on the identified indicators using a calibrated multi-criteria consensus framework.
3. To examine the applicability of the developed competencies in professional education and public health-related communication contexts.

Methodology

The study followed a multi-phase research framework integrating expert-based consensus development and empirical validation. A three-round iterative Delphi process was conducted, as two to three rounds are generally considered sufficient for achieving stable consensus in Delphi studies [6, 19]. Panel members were chosen based on their expertise, professional experience, and willingness to participate in multiple rounds of consultation. The panel composition followed recommendations suggesting that 15–30 experts are appropriate for homogeneous Delphi panels [1, 27].

In the first round, experts were invited through an open-ended questionnaire to identify key communication competencies required for extension professional development. Responses were analysed using content analysis, and similar statements were grouped and consolidated to generate a preliminary list of communication skill indicators.

In the second round, the identified indicators were presented to the panel members in a structured questionnaire and evaluated using a five-point Likert scale ranging from 1 (not important) to 5 (very important). The responses were analysed to assess both the perceived importance of each indicator and the level of agreement among experts.

The third round provided experts with summarized results from the previous round and allowed them to reconsider their ratings. This controlled feedback mechanism enabled experts to review the collective opinion of the group and refine their judgments, thereby facilitating convergence toward consensus.

Since Delphi studies do not follow a universally accepted criterion for determining consensus [13], the present study adopted a calibrated multi-criteria consensus approach. The importance of each indicator was assessed using the median, while agreement among experts was evaluated using the interquartile range (IQR) and quartile deviation. In addition, percentage agreement was used to determine the proportion of experts assigning high importance to each indicator. Indicators with higher median values and lower dispersion statistics were considered to demonstrate stronger expert consensus.

The criteria used for evaluating indicator importance and consensus are summarized in the following table.

The Delphi process concluded after three rounds once stable patterns of expert agreement were observed. Anonymity of the panel members was maintained throughout the process to ensure independent judgment and minimize potential bias. By integrating multiple statistical indicators rather than relying on a single consensus measure, the approach improves the transparency, reliability, and methodological rigor of indicator development in educational research.

To examine the practical relevance of the generated indicators, a training needs analysis was conducted among students in agriculture and nutrition education. For this purpose, three leading agricultural institutions in India were purposively selected based on their performance in the National Institutional Ranking Framework (NIRF, Ministry of Education, 2024), which evaluates universities on parameters such as research, graduation outcomes, outreach, and perception.

To capture institutional diversity, the study included a Deemed University (Indian Agricultural Research Institute, IARI), a State Agricultural University (G.B. Pant University of Agriculture and Technology, GBPUAT), and a Central University (Banaras Hindu University, BHU). These institutions represent prominent centres of higher agricultural and nutrition education in India.

The study targeted postgraduate students. Respondents were required to be registered in master's or doctoral programs and to have exposure to academic communication activities such as seminars, coursework, and research presentations. Using stratified sampling, seventy students were selected from each institution, resulting in a total sample of 210 respondents, representing diverse agricultural disciplines.

The Training Need Index (TNI) for the generated communication skill indicators was computed using the following formula [25]. The Training Need Index is calculated by dividing the total obtained score by the maximum obtainable score and multiplying by 100:

$$\text{TNI} = \left(\frac{\text{Total Obtained Score}}{\text{Maximum Obtainable Score}} \right) \times 100 \quad (1)$$

The skill gap or training need is calculated as:

$$\text{Skill Gap (Training Need)} = 100 - \text{TNI} \quad (2)$$

A lower value of TNI indicates a greater magnitude of training need, and vice versa. The Training Need Index is also used to prioritize training requirements. The respondents were classified into three groups—low, medium, and high levels of training needs—following the approach suggested by [14]. The cumulative square root frequency method was used to categorize respondents within each university.

The communication competencies assessed in this study are based on students' self-perceived levels of competence and importance of specific communication skills. Therefore, the Training Need Index reflects perceived communication training needs rather than objectively measured communication proficiency.

Perception-based assessment is widely used in training need analysis because it captures learners' subjective evaluation of their own skill gaps and identifies areas where they feel additional training or support is required. However, such assessments may also be influenced by individual self-evaluation tendencies. Therefore, the findings should be interpreted as indicators of perceived communication skill gaps among postgraduate students.

Results

A panel of 30 experts representing the fields of extension, education, and communication related to agriculture and nutrition was constituted to identify and validate communication skill indicators relevant to postgraduate students. The majority of experts had more than 8 years of professional experience in education and communication training. The diverse professional backgrounds of the panel ensured comprehensive expert perspectives during the indicator development process.

Table 1. Criteria used for determining importance and consensus in the Delphi study

Statistical Measure	Purpose	Interpretation
Median	Determines perceived importance of indicators	Higher median indicates greater importance
Interquartile Range (IQR)	Measures agreement among experts	Lower IQR indicates stronger consensus
Quartile Deviation (QD)	Assesses dispersion of responses	Lower QD reflects higher stability of responses
Percentage Agreement	Indicates proportion of experts rating the indicator as important	Higher agreement supports stronger consensus

To ensure adequate participation, reminder emails and follow-up phone calls were used throughout the Delphi process. Out of the 30 experts invited, 25 experts participated in Round I, resulting in an 83.3% response rate, while 23 experts participated in both Round II and Round III, yielding a 76.6% participation rate.

The first round of the Delphi process aimed to generate communication skill indicators relevant to postgraduate agricultural students. Experts responded to an open-ended questionnaire designed to identify competencies considered essential for effective professional communication. The responses were analysed using content analysis and the constant comparative method. Similar statements were merged and duplicates were removed, resulting in the identification of 37 preliminary communication skill indicators.

The indicators identified in Round I were evaluated in Round II using a structured questionnaire in which experts rated each item on a five-point Likert scale ranging from 1 (not important) to 5 (very important).

For determining consensus, [30] suggested that consensus may be assumed when at least 60% of respondents agree on a five-point scale. The use of interquartile range (IQR) as a rigorous measure of consensus was recommended by [5], who noted that an IQR $\leq$ 1 indicates strong agreement. Similarly, dispersion-based approaches using quartile deviation have been supported in Delphi methodology literature [11].

These established criteria guided the consensus thresholds adopted in the present study. Indicator importance was classified as very high if the median value was ≥ 4 and at least 80% of respondents rated the item as 4 or 5 [7]. Since Delphi studies do not follow a universally accepted criterion for determining consensus, the study adopted a context-specific calibrated multi-criteria approach combining measures of central tendency and dispersion to evaluate both expert agreement and indicator importance.

Consensus levels were assessed using quartile deviation (QD) and interquartile range (IQR). Indicators were considered to demonstrate:

- High consensus when QD ≤ 0.5 and IQR ≤ 1
- Medium consensus when QD ranged between 0.5 and 1 and IQR ranged between 1 and 2
- No consensus when QD > 1 and IQR > 2

Indicator importance was determined using the median value and percentage agreement. An indicator was considered to have very high importance when the median value was ≥ 4 and at least 80% of experts rated the item as either 4 or 5.

Applying the calibrated criteria, after Round II, a total of 26 communication skill indicators demonstrated high consensus (QD ≤ 0.5 and IQR ≤ 1) and moderate importance, with a median value greater than 4 and at least 66.6% of experts rating the indicators as either 4 or 5. These indicators were retained for further evaluation.

In Round III, the same indicators were presented to the expert panel along with statistical summaries from the previous round to allow participants to reconsider their ratings. This controlled feedback process facilitated convergence of expert judgments. After Round III, 11 communication skill indicators satisfied the final consensus criteria, demonstrating high consensus (QD $\leq$ 0.5 and IQR ≤ 1) and very high perceived importance (Median ≥ 4 with at least 80% agreement). These indicators were therefore retained as the final validated communication skill indicators for postgraduate agricultural students.

The Training Need Index (TNI%) was used to assess the priority of training requirements across different communication skill indicators. The results indicate varying levels of training needs among postgraduate agricultural students across the identified communication competencies.

Among the eleven communication skill indicators assessed, “Initiating an attractive opening during group discussions” recorded the lowest TNI value (66.95), in-

Table 2. Details about the panel

Characteristic	Experience (years)	Frequency (selected panel)	Frequency (round I)	Frequency (round II & III)
Professor	>20	6	4	4
ssociate professor	≥ 15	4	4	3
ssistant professor	≥ 8	10	8	8
scientist	≥ 8	3	3	3
senior scientist	>8	2	2	2
Principal scientist	≥ 20	5	4	3

Table 3. Multi-Criteria Consensus Framework Used for Delphi Indicator Validation

Criteria Category	**Statistical Measure**	**Threshold Applied**	**Interpretation**
Consensus Level	Quartile Deviation (QD) & Interquartile Range (IQR)	QD ≤ 0.5, IQR ≤ 1	High consensus and strong agreement among experts
		$0.5 <$ QD ≤ 1, $1 <$ IQR ≤ 2	Moderate consensus and agreement
		QD > 1, IQR > 2	No consensus and weak agreement
Indicator Importance	Median Value	Median ≥ 4	Indicator considered highly important
	Percentage Agreement (Respondents rating ≥ 4)	$\geq 80\%$ 66.6–80% $< 66.6\%$	Very high importance Moderate importance Less importance
Indicator Retention Rule (Round II)	Combined Criteria	QD ≤ 0.5, IQR ≤ 1, Median ≥ 4, $\geq 66.6\%$ agreement	Indicator retained for Round III
Indicator Retention (Final)	Combined Criteria	QD ≤ 0.5, IQR ≤ 1, Median ≥ 4, $\geq 80\%$ agreement	Indicator retained as final consensus

dicating the highest priority training need. This was followed by “Persuasion and vividness” (68.10) and “Voice modulation” (68.38). These findings suggest that students face greater difficulty in interactive and spontaneous communication contexts, which typically demand higher cognitive processing and real-time response [21].

Indicators such as sequencing content, technical articulation, and impactful delivery also reflected notable training needs. In contrast, public speaking (71.52) recorded comparatively lower need. This may be attributed to the structured nature of public speaking, where preparation reduces anxiety and improves performance [10]. Overall, the results indicate that unstructured and interactive communication situations pose greater challenges than formal presentations, consistent with communication apprehension literature [20].

Institution-wise analysis revealed that GBPUAT recorded the highest proportion of students with high training need (37.14%), whereas IARI showed the highest proportion of low training need (45.71%). This variation may be linked to differences in academic exposure, communication training opportunities, and institutional emphasis on soft skills development

Table 4. Delphi Round-wise Reduction of Communication Skill Indicators

Delphi Round	Purpose of Round	Number of Experts Participated	Indicators Evaluated	Indicators Retained
Round I	Generation of communication skill indicators through open-ended responses	25	—	37
Round II	Evaluation of indicators using Likert scale and preliminary consensus analysis	23	37	26
Round III	Re-evaluation of indicators with controlled feedback to achieve final consensus	23	26	11

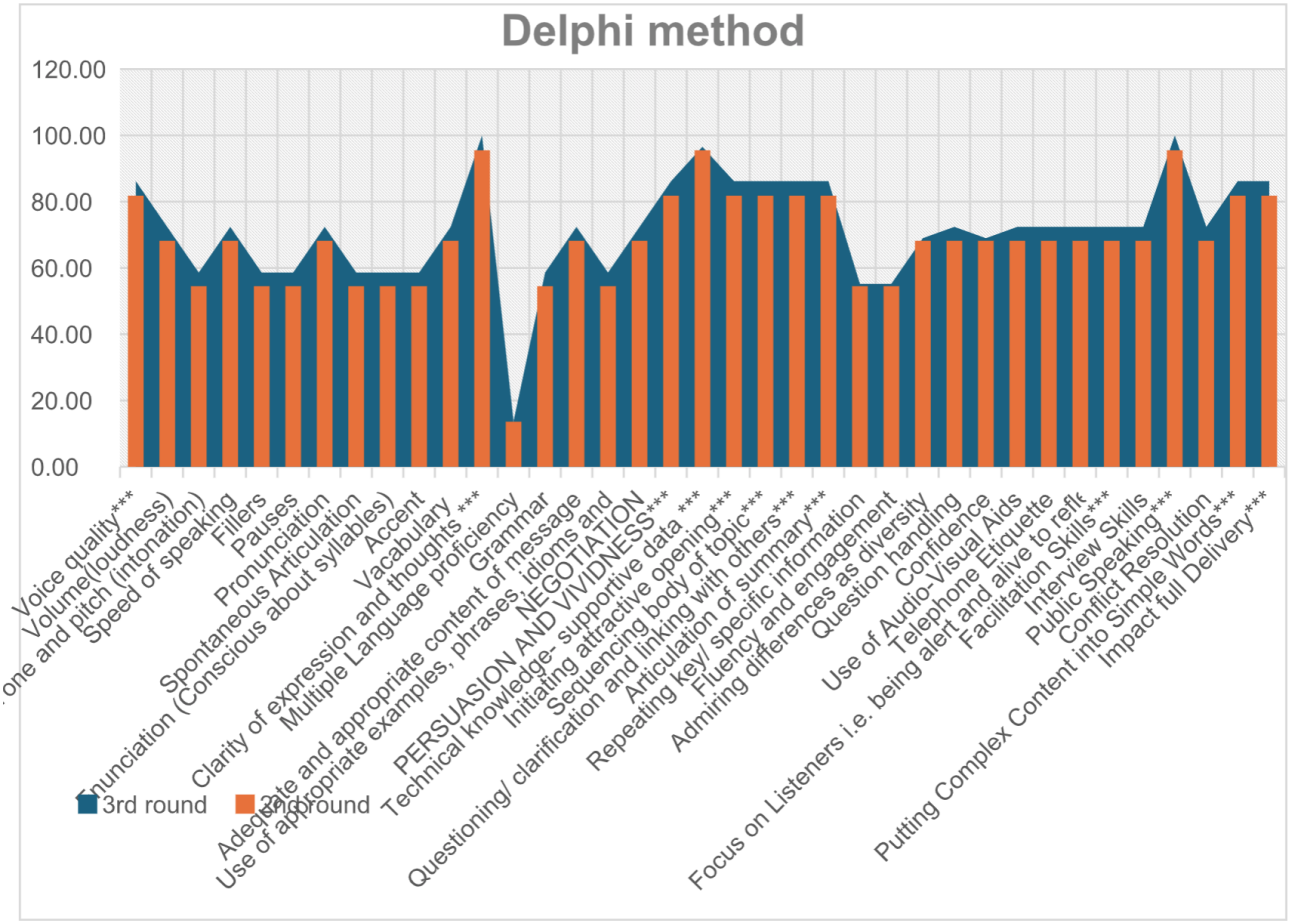

*Figure 1Delphi Technique(***items included in the study)*

[23]. BHU reported the highest proportion in the medium category (51.43%), suggesting that students possess basic communication competence but require further refinement and practice. These findings align with earlier studies indicating that students often exhibit moderate communication proficiency but lack advanced articulation and confidence [3].

The Friedman test revealed a significant difference in

Table 5. Results of Delphi Round II and Round III

S.N	Communication Skills Indicators	Median	IQR	QD	2nd Round %	3rd Round %
1. PROPER USE OF VOCALICS						
1. Modulation						
a.	Voice quality***	4	2	1	81.8	86.2
b.	Volume (loudness)	4	2	1	68.2	Dropped
c.	Tone and pitch (intonation)	4	2	1	54.5	Dropped
d.	Speed of speaking	4	1	0.5	68.2	72.4
e.	Fillers	4	1	0.5	54.5	Dropped
f.	Pauses	4	1	0.5	54.5	Dropped
II. Bringing emotion in speech (expression)						
a.	Pronunciation	4	2	1	68.2	Dropped
b.	Spontaneous articulation	4	1	0.5	54.5	Dropped
c.	Enunciation (conscious about syllables)	4	1	0.5	54.5	Dropped
d.	Accent	4	2	1	54.5	Dropped
2. VERBAL ENCODING						
I.	Vocabulary	5	2	1	68.2	Dropped
II.	Clarity of expression and thoughts***	4	1	0.5	95.5	100
III.	Multiple language proficiency	3	0	0	13.6	Dropped
IV.	Grammar	4	1	0.5	54.5	Dropped
V.	Adequate and appropriate content	4	2	1	68.2	68.2
VI.	Use of examples, idioms, quotes	4	1	0.5	54.5	Dropped
3.	Negotiation	4	2	1	68.2	Dropped
4.	Persuasion and vividness***	4	1	0.5	81.8	86.2
5. GROUP DISCUSSION, DEBATE, PRESENTATION SKILLS						
I.	Technical knowledge***	4	1	0.5	95.5	96.5
II. Design						
a.	Initiating attractive opening***	4	1	0.5	81.8	86.2
b.	Sequencing body of topic***	4	0	0	81.8	86.2
c.	Questioning/clarification***	4	0	0	81.8	86.2
d.	Articulating summary***	4	1	0.5	81.8	86.2
III.	Repeating key information	4	1	0.5	54.5	Dropped
IV.	Fluency and engagement	4	1	0.5	54.5	Dropped
V.	Admirng differences as diversity	4	1	0.5	68.2	68.9
VI.	Question handling	5	2	1	68.2	Dropped
VII.	Confidence	5	2	1	68.2	Dropped
6.	Use of Audio-Visual Aids	4	1	0.5	68.2	72.4
7.	Telephone Etiquette	4	2	1	68.2	Dropped
8.	Focus on listeners	4	2	1	68.2	Dropped
9.	Facilitation Skills***	4	2	1	68.2	Dropped
10.	Interview Skills	4	2	1	68.2	Dropped
11.	Public Speaking***	4	1	0.5	95.5	100
12.	Conflict Resolution	4	1	0.5	68.2	72.4
13.	Putting Complex Content into Simple	4	0	0	81.8	86.2

communication skills across institutions ($\chi^2 = 10.941$, $p = 0.004$). Mean rank values indicated higher performance in BHU (2.19) and IARI (2.12) compared to GBPUAT (1.69).

Since the Friedman test only indicates the presence of statistically significant differences among groups without specifying where those differences occur, the Wilcoxon signed-rank test was performed for pairwise comparisons. The results showed significant differences between IARI–GBPUAT ($p = 0.005$) and GBPUAT–BHU ($p < 0.001$), while no significant difference was observed between BHU–IARI ($p = 0.838$).

Discussion

The study provides a comprehensive assessment of communication skill gaps among postgraduate students and demonstrates the effectiveness of a Delphi-based multi-criteria consensus framework in identifying and validating key communication competencies. The findings reveal that students exhibit moderate to high training needs in communication skills, particularly in interactive domains such as initiating discussions, persuasive communication, and voice modulation. These competencies are critical for effective participation in academic and professional commu-

Table 6. Communication skills Results of TNI

S.N.	Communication skills Indicators	TNI%	Rank
1	Voice quality (Modulation)	68.38	3
2	Clarity of expression and thoughts (VE)	70.10	9
3	Initiating attractive opening(GD)	66.95	1
4	Sequencing body of topic (GD)	68.67	4
5	Questioning/ clarification and linking with others	69.24	8
6	Articulation of summary(GD)	70.29	10
7	Technical knowledge of the topic with supportive data and examples (GD)	68.76	5
8	Persuasion And Vividness	68.10	2
9	Public Speaking	71.52	11
10	Putting Complex Content into Simple Words	68.95	7
11	Impact full Delivery	68.76	5

TNI%=Training Need Index Percentage

Table 7. Distribution of Students Based on Training Need Levels

S.N	Communication skills	Category	GBPUAT (n=70)		IARI (n=70)		BHU (n=70)		Total Students (n=210)	
			f	%	f	%	f	%	f	%
1	High	< 57.31	26	37.14	14	20.00	6	8.57	46	21.90
2	Medium	57.31–74.22	22	31.43	24	34.29	36	51.43	82	39.05
3	Low	> 74.22	22	31.43	32	45.71	28	40.00	82	39.05

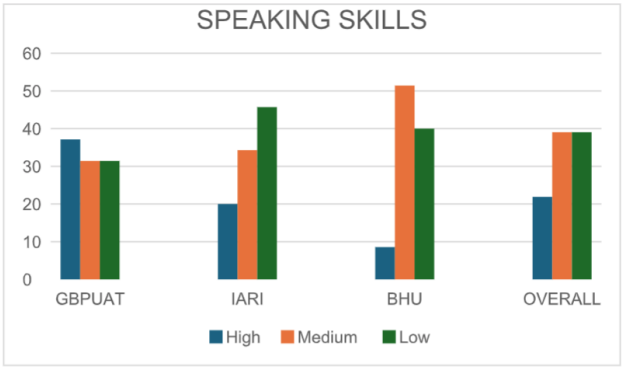

Figure 2 Distribution of students according to their speaking skill

nication contexts, yet similar deficiencies have been consistentl reported in agricultural and technical education (Bharathi, 2016; Qizi, 2020). The application of the Delphi technique in this study resulted in the identification of 11 validated communication skill indicators, achieving high consensus (QD 0.5, IQR 1) and strong importance ratings (Median 4; 80% agreement). This confirms the robustness of the Delphi method in competency identification, particularly in exploratory educational contexts. Consistent with earlier studies, the iterative feedback mechanism enabled convergence of expert opinions, transforming an initial pool of indicators into a refined and actionable framework (Franklin, 2011). Importantly, the study addresses a key methodological limitation in Delphi research, the absence of a universal consensus criterion (Hung et al., 2008), by adopting a calibrated multi-criteria consensus approach integrating measures of central tendency, dispersion, and agreement. This aligns with recommendations by De Vet et al. (2006) and Gordon (2009), thereby enhancing the transparency and reliability of consensus determination. The progressive increase in consensus across rounds reflects the commonly observed convergence or bandwagon effect in Delphi studies (Von der Gracht, 2012). While some scholars caution that this may reduce diversity of opinion or introduce groupthink (Mitchell, 1991), it also highlights the effectiveness of controlled feedback in refining expert judgments. The relatively high consensus achieved in this study may further be attributed to the homogeneity of the expert panel and the focused scope of communication skills, as broader or more heterogeneous domains tend to produce lower agreement (Hsu amp; Sandford, 2007; Schmidt, 1997). Additionally, the findings support the view that Delphi is particularly effective for structured competency development in educational contexts (Okoli & Pawlowski, 2004; Duncan et al., 2014; Yousuf, 2007; Linstone amp; Turoff, 1975; Helmer, 1983). The Training Need Index analysis further indicates that interactive and delivery-oriented communication competencies represent the most critical gaps among postgraduate students. Skills such as initiating group discussions, persuasive communication, and voice modulation emerged as high-priority training needs, highlighting deficiencies in both engagement and expressive dimensions of communication. These findings are supported by Duncan et al. (2014), who emphasized

Table 8. Statistical analysis depicting difference of communication skills among institutes

Friedman Test				
Indicators	**Universities**	**Mean Rank**	**Chi-square**	**Sig.**
Communication skills	GBPUAT	1.69	10.941	0.004**
	IARI	2.12		
	BHU	2.19		
Wilcoxon Signed Rank Test				
		IARI – GBPUAT	**GBPUAT – BHU**	**BHU – IARI**
Communication skills	Z	-2.781^b	-0.205^b	-3.494^b
	Sig (2-tailed)	0.005**	< 0.001**	0.838

*Significance level at 5 percent, ^{b}Based on negative ranks

the importance of vocal delivery and clarity in effective communication. However, they partially contrast with studies such as Subramanian, K. R. (2017), which place greater emphasis on content structuring. The present study suggests that in the context of agricultural and nutrition education, particularly where extension and stakeholder interaction are central, both delivery and content-related competencies are equally important. These gaps can be further interpreted through theoretical perspectives. Social Cognitive Theory (Bandura, 1997) suggests that skill acquisition depends on practice, observation, and self-efficacy, while Experiential Learning Theory (Kolb, 1984) emphasizes the role of active engagement and reflection. The observed training needs indicate that such experiential and participatory learning opportunities may be insufficiently integrated into existing agricultural curricula. Moreover, the findings align with Communication Apprehension Theory (McCroskey, 1977), suggesting that higher training needs in interactive communication contexts may reflect underlying communication anxiety. Students may find spontaneous communication situations more challenging than structured tasks, reinforcing the need for interventions that address both skill deficits and psychological barriers. The study also revealed statistically significant differences in communication skills across institutions, indicating that communication competence is influenced by institutional context and academic exposure. Students from IARI and BHU demonstrated comparatively stronger communication competencies than those from GBPUAT, suggesting that institutional emphasis on seminars, presentations, and interactive learning environments plays a critical role in skill development. This finding is consistent with Robinson and Garton (2008), who highlighted the importance of experiential academic environments in enhancing employability skills. Overall, the study contributes to the existing literature in two important ways. First, it provides empirical evidence on communication skill gaps among postgraduate agricultural students, with a specific focus on communication competencies. Second, it advances Delphi methodology by proposing a calibrated multi-criteria consensus framework that enhances the rigor and transparency of consensus determination. This approach offers a replicable model for future competency and indicator development studies in educational and professional research contexts. From a broader perspective, the findings reinforce the need to reposition communication competence as a core professional skill in higher education. Agricultural and nutrition graduates are required to operate in complex, multi-stakeholder environments where effective communication is essential for research dissemination, extension services, and policy engagement (Moore amp; Morton, 2017). The integration of a validated communication competency framework, supported by a robust Delphi methodology, provides a strong foundation for designing targeted training interventions. By incorporating experiential learning approaches, communication practice modules, and confidence-building strategies, agricultural universities can enhance both the competence and confidence of students, ultimately improving the effectiveness of agricultural extension systems and knowledge transfer processes.

Practical Implications for Agricultural Extension

The findings have important implications for professional education and public health-related communi-

cation systems, where communication competencies are central to knowledge dissemination, stakeholder engagement, and behavioural change, particularly in rural and agricultural contexts (Leeuwis amp; Van den Ban, 2004; Davis, 2008). The Delphi-based identification of communication skill indicators provides a validated framework to guide curriculum design and capacity-building programs. The identified gaps, especially in discussion initiation, persuasion, and clarity of expression, highlight the need for structured and practice-oriented communication training within universities. Experiential learning approaches such as group discussions, role plays, mock presentations, and field-based simulations can enhance communication competence (Kolb, 1984). In addition, context- specific training is essential to prepare students to engage effectively with diverse stakeholders, including farmers, policymakers, and interdisciplinary teams. From a public health perspective, strengthening communication competencies is important for effectively conveying information related to nutrition, environmental health, and sustainable practices (Rivera amp; Sulaiman, 2004). The findings also emphasize the need for institutional support systems, such as communication skill development centres and continuous training programs. Integrating communication training as a structured, credit-based component within curricula can support systematic skill development and improve professional preparedness (Robinson amp; Garton, 2008). Furthermore, the calibrated Delphi framework offers a transparent and evidence-based approach for developing competency indicators applicable across interdisciplinary and public health communication contexts.

Limitations of the Study

Despite its contributions, the study has certain limitations. First, the research was confined to three leading institutions in extension of agricultural and nutrition, which may limit the generalizability of the findings to other universities with different institutional contexts. Future studies may include a larger and more diverse sample across regions. Second, the study relied on self-reported data, which may be subject to response bias. Incorporating objective measures of communication performance, such as observational assessments or performance-based evaluations, could enhance the robustness of the findings (Podsakoff et al., 2003). Third, while the Delphi technique ensured systematic expert validation of communication skill indicators, the outcomes may be influenced by panel composition and convergence effects across rounds. Future research may involve more diverse expert panels and cross-validation of indicators in different educational settings. Finally, the study primarily focused on speaking skills, whereas communication competence is inherently multidimensional, encompassing writing, listening, and non-verbal communication. Future studies may adopt a more comprehensive approach to examine the full spectrum of communication competencies required in agricultural education and extension.

Conclusion

The present study highlights the critical role of communication competence, particularly communication skills, in shaping the professional preparedness of postgraduate students. The findings reveal that a substantial proportion of students exhibit moderate to high training needs, especially in interactive communication domains such as initiating discussions, persuasive expression, and voice modulation. These gaps indicate that, despite strong technical knowledge, students face challenges in effectively expressing ideas and engaging in professional communication contexts. The observed institutional variations further indicate that communication competency development is influenced by the academic environment and exposure to communication-intensive learning experiences. Methodologically, the study addresses a key limitation in Delphi-based research by proposing a calibrated multi-criteria framework for consensus determination. By integrating measures of central tendency and dispersion, the framework provides a transparent and replicable approach for identifying communication competencies through expert consensus. The application of this approach resulted in a refined set of indicators demonstrating high levels of importance and agreement, thereby strengthening the rigor and consistency of competency development processes. The observed institutional differences further suggest that communication skill development is influenced by academic environment and exposure to communication-intensive learning activities. This underscores the need for integrating structured, practice-oriented communication training within postgraduate curricula.

From a broader policy perspective, the findings align with the vision of the National Education Policy (NEP) 2020, which emphasizes the development of holistic, multidisciplinary, and skill-oriented education, including communication, critical thinking, and experiential learning. The identified gaps in communication competencies indicate the need for stronger implementation of NEP recommendations within higher education, particularly through the integration of communication skill modules, experiential learning approaches, and continuous formative assessment mechanisms.

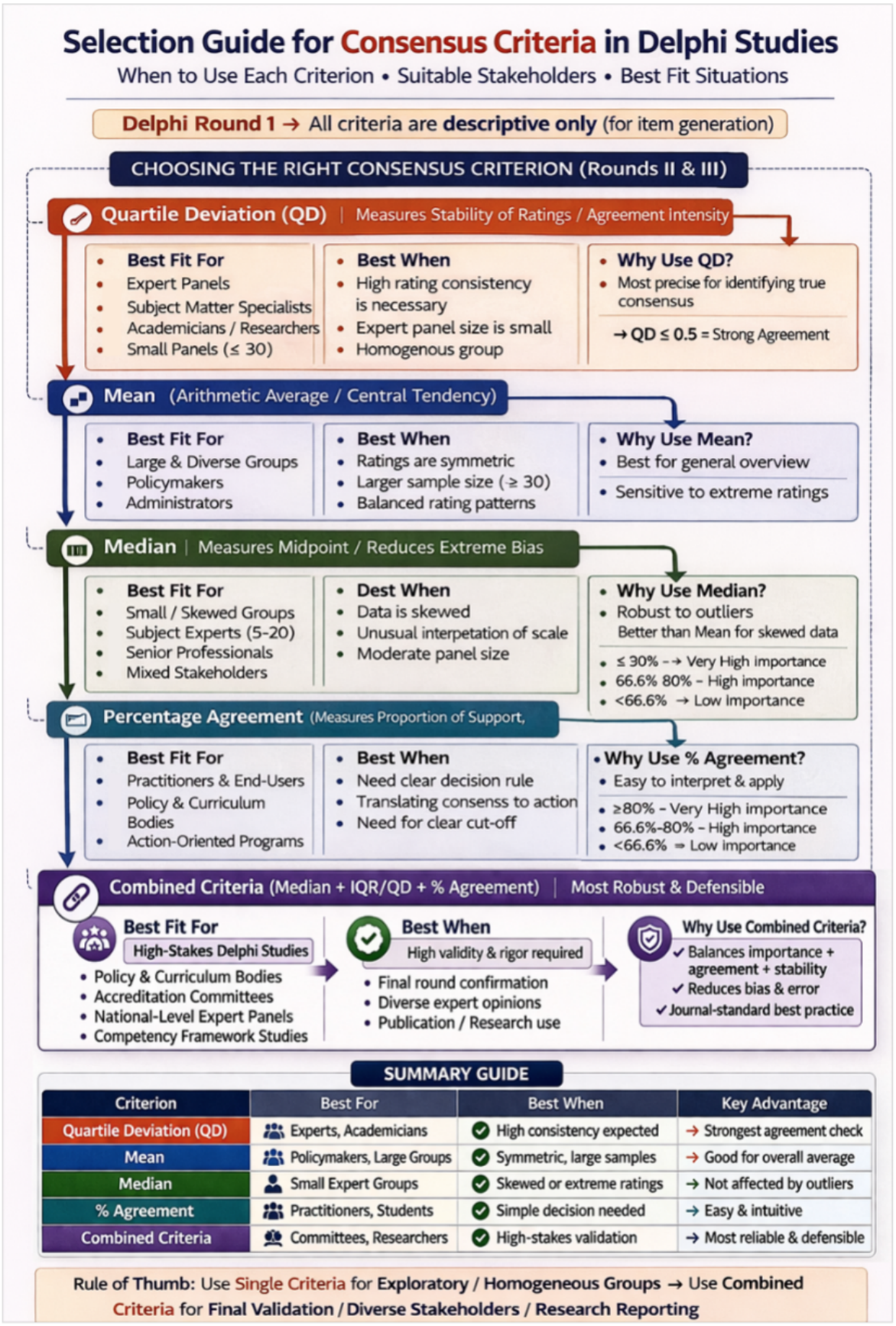

Figure3 Calibrated Delphi consensus framework (CDCF)

Embedding communication training as a core, credit-bearing component within postgraduate programs can help bridge the disconnect between technical knowledge and professional application. Strengthening com-

munication competencies is essential not only for academic and professional effectiveness but also for improving knowledge dissemination, extension services, and stakeholder engagement. By adopting targeted interventions that combine skill development with confidence-building strategies, universities can better prepare graduates to meet the complex communication demands of modern nutrition, environmental health, and sustainable systems and contribute for improved professional readiness and societal outcomes.

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