Gap Analysis of Higher Agricultural Education Competencies among the Students for Industrial and Farmers' Needs

Manmeet Kaur[1] and Anupam Anand[1*]

[1]Department of Extension Education, Punjab Agricultural University, Ludhiana, India.

Authors' contributions

This work was carried out in collaboration between both authors. Author MK designed the study. Author AA performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors MK and AA managed the analyses of the study. Author AA managed the literature searches. Both authors read and approved the final manuscript.

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ABSTRACT

The study was conducted to outline competencies relevant to the need of farmers and industries present in an agriculture graduate for carrying out their assigned duties. As inferred by mean score of the desired status, the managerial competency was identified to be the most needed one among the agricultural graduates as perceived by the students followed by entrepreneurial, extension skills, technical, market/understanding government policy, communication/ICT and personal competency. The findings of the study will aid higher education planners in India to develop curriculum to prepare and train future agricultural graduates to educate, inform and entertain farmers in an efficient way and fulfil the requirements of the job as required by the industries in an agriculture graduates. Specifically, the research sought to determine students and farmers perceptions of essential competencies needed by agri-graduates enrolled in the agriculture curriculum. The study provides for an initial attempt to gain insight into how higher agricultural education institutions can revitalize their curricula to better prepare their students for the market place and to keep pace with the changing nature of the environment around them.

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Corresponding author: E-mail: anupamanand1989@hotmail.com;

1. INTRODUCTION

The competencies among the agricultural graduates is crucial for their career development [1]. But apart from the career prospects, these competencies play a major role in agriculture development of the country. India is an agrarian nation with more than 60 percent of its population wholly or significantly dependent on agriculture and allied activities for their livelihood. Agriculture sector is the mainstay of the Indian economy, contributing about 15 per cent of national Gross Domestic Product (GDP Development of agriculture will help in upliftment of the farmers but also benefit the larger section of the rural poor who are directly engaged in agriculture or indirectly linked with agriculture as consumers. Efficient way of production, stabilized prices, higher income from agriculture would create a more conjugative environment in the country for the development of the economy as a whole and of rural population in particular. Agriculture is continuously changing [2]. Technology, humanity's needs and finite resources are all influencing agricultural practices, methods and the need for education. In order to address the needs of humanity, universities and career preparation institutions must provide a well-educated and prepared workforce to confront the problems that face the success of civilization [3,4,5]. The results of the constant change in human's needs result in the need for continual and persistent change in our workforce and education [6]. The agricultural universities are imbibed with a role to prepare efficient agricultural researchers, extensionists, industrialists and entrepreneurs. Also, technological advancements coupled with the need for greater economic efficiency [7] and agricultural sustainability demands proficient and competent graduates for this sector. With rapid economical, ecological and technological changes occurring, reconciliation must be made to stay abreast with new developments [8,9,10].

Competency is a cluster of related knowledge, attitudes, and skills [11], abilities and behaviours [12]. Knowledge is the fact or condition of knowing something with familiarity gained through experience and supported professionally by acceptable theory and research. Skill is the dexterity or coordination in the execution of learned tasks. This requires special training to achieve the desired results with minimal investment of time and energy. Ability is an acquired or natural capacity or talent that enables an individual to perform a particular job or task successfully. Inclusively, knowledge, skill and ability refers to competency. It can be said that competency is a set of defined behaviours that provide a structural guide enabling the identification, evaluation and development of the behaviours in individuals.

In the present context of agricultural education in India, a major challenge is that the students are generally trained theoretically and narrowly rather than practically and experientially.

Besides, the linkages and interaction amongst the stakeholders in agricultural sector viz. educational institution, industry and farmers is minimal which affects the identification of required competencies [13,14].

India, in the present scenario is witnessing a burgeoning growth of agricultural universities and colleges with inadequate infrastructure and competent staff. This is indeed, impeding the quality of agricultural education. The agricultural universities need to be accountable for ensuring the academic excellence so as to be able to produce a generation of outstanding researchers, extensionists and academicians who are competent enough to constitute a positive and significant technological, economic and social impact in the society. However, not many studies had been conducted previously to determine the competencies needed in agricultural graduates and how these competencies could be integrated into an agricultural education curriculum. Keeping this in mind, the study was undertaken with the sole objective to assess the gaps in the higher agricultural education competencies among the students with respect to industrial and farmers' needs as perceived by the students and farmers.

2. METHODOLOGY

The study was conducted in Punjab Agricultural University, Ludhiana and its constituent colleges present under the university. And, the study comprised of three 300 students from the Punjab Agricultural University as its respondents. Also, 70 progressive farmers were selected for the study for in-depth probing and understanding of their views regarding the higher agricultural education competencies among the students. A

descriptive research study was used to determine the higher agricultural education competencies of the university agricultural graduates and post-graduates in the state of Punjab pertaining to the farmers and industrial needs. Creswell (2008) indicated that survey research enables the researcher to describe the attitudes, opinions, behaviours, or characteristics of a population by administering a survey to a sample or to the entire population. The data were collected by distributing the questionnaire among the students. Proper precautions were taken to ensure unbiased response of the respondents by providing them necessary instructions after explaining the objectives of the study. To ensure confidentiality, the questionnaire did not include any questions regarding names or addresses of participants. Z-test was used to find out the significance of difference of the existing status and desired status of the competencies as perceived by the students.

3. RESULTS AND DISCUSSION

3.1 Students Perception of Existing and Desired Higher Agricultural Education Competencies

The data in Table 1 presents the seven general competencies with their mean and standard deviation. The competencies have been ranked on the basis of the calculated mean to see which competency is more important than the other. The above mentioned statistics were computed by assigning a numerical value to each category of the scale employed for measuring the existing and desired status of the identified competencies.

As shown in Table 1, the total mean for existing agricultural education competencies among the students revealed a fairly low level (*TM* = 1.928). This illustrates an inadequacy of the identified competencies among the students pertaining to farmers and industrial needs. Regarding the desired level of agricultural competencies needed for the farmers and industrial needs, the results showed a fairly high total mean (*TM* = 2.683) as compared to the existing status. Therefore, the students believed that agricultural competencies are highly needed. From the results, the following agricultural competencies for the desired status were ranked individually according to their calculated mean which indicated their importance in the descending order viz. managerial (*M*= 2.928), entrepreneurial (*M*=2.898), extension skills (*M*= 2.830), technical

(*M*=2.814), market/understanding government policy (*M*=2.783), communication/ICT (*M*= 2.602) and personal competency (*M*= 1.928).

A scrutiny of data in Table 1 indicate that the students perceive managerial competency to be the most important one that needs to be developed among them in the present scenario with regard to the fulfilment of farmers and industrial needs. The calculated existing mean (*M* = 2.117) was found to be higher than the total mean and for the desired status the mean calculated (*M* =2.928) was again higher than the total mean. The high calculated mean suggested that the students considered managerial competency to be the most needed competency of all which needed to be cultivated because in the lieu of scarce resources the pressure to have more food crops, commercial crops and animal husbandry with the help of modern agricultural practices has led to the stripping of large areas of forests and using great amounts of water and energy. As a result large scale soil erosion and local climate change have occurred. All these have combined to deplete and endanger some of our most valuable natural resources. Clearly, a good case exists to manage our natural resources and conserve the environment which can be well managed if the agricultural students have well defined competencies regarding managerial capacity in them. Beside this, the students need to know how to efficiently and effectively deploy the scarce resources of an organization when they are needed. Such resources may include financial resources, inventory, human skills, production resources, or information technology (IT).

In order to study the gap between the existing and desired status of second most important entrepreneurial competency, Z-test was used. As shown in Table 1, there was a significant difference between the existing and desired status of the competency. The results showed that students of agricultural education require various features and attributes for future success in obtaining jobs especially in the private and NGOs sectors and one of the most important of these competencies are entrepreneurial competencies which the students should take them through university and academic courses. Other reason for considering the entrepreneurial competency by the students is the lack of employment in the field of agriculture. After a thorough discussion with the stakeholders it was found that the students need to be equipped with technical knowledge and skill in the agricultural

area of specialization in which to establish a business venture, appropriate knowledge and understanding of the market in the area of specialization; ability to assess the unmet needs of customers and market in this area of expertise, conduct an effective market research in the area of specialization; conduct feasibility study on whether the developed idea is practical, knowledge and skill to estimate and manage the risk of entering in the market in the area of specialization, etc. It was further suggested that higher agricultural education can contribute to create a more entrepreneurial disposition among students by integrating programs into the mainstream offerings to develop the identified competencies in this study. They must apply hands-on entrepreneurial business related environment and scenarios that stimulate entrepreneurial activities. Placements of students in situations where they can work with and observe the operation of a successful business.

The results in Table 1 indicated that for the extension skills the existing status mean (*M*= 2.076) was higher than the low total mean of existing status of all competencies (*TM*=1.928). For the desired level of extension skills as required by the farmers and industrial needs, the results show a mean rank as high as 2.830 and *SD*=0.0737. Accordingly, the extension skills have been deemed as one of the most important competencies for the farmers and industrial needs by the students as the transfer of technology, innovations and ideas can only

effectively takes place when the students possesses good extension skills. The extension skills developed in the students will enable them to become good extension workers who are holistic thinkers, good problem solvers, have excellent empathy skills trained in dealing with complex technical and social situations. Extension professionals are judged on how they serve their clients, interact with them and how familiar they are with their clients' contexts and issues.

Regarding the technical competency, the data in Table 1 revealed that the existing status and desired status both had the same rank but there was a significant difference between the existing status and desired status indicated that the technical competency building was required. The existing status mean (*M*=1.952; *SD*=0.1488) had a slightly higher score than the total mean. For the desired status the calculated mean (*M* = 2.814; *SD*=0.2949) showed a moderate difference from the existing one. The results showed that the students lacked technical knowledge about various aspects in agriculture. Employees at all levels consistently cite the importance of technical competence in their leaders. First, this is a respect issue. Second, it is a direction issue. Employees correctly believe that if the boss doesn't know what they do and how they do it, he will be unable to make the right decisions on how to effectively employ them, implement changes that positively impact performance, and improve the team's ability to capitalize on future opportunities.

Table 1. Students perception of existing and desired higher agricultural education competencies (n=300)

S. no.	Competencies	ES (M)	ES (SD)	R*	DS (M)	DS (SD)	R*	M*	Z - Score
1.	Personal	1.644	0.2151	7	1.928	0.5832	7	0.284	-1.023
	Leadership	1.414	0.1315	P5	1.577	0.2777	P5	0.163	
	Team Spirit	1.664	0.2281	P2	1.692	0.3065	P3	0.028	
	Professionalism / Work Ethics	1.539	0.1904	P4	1.631	0.2256	P4	0.092	
	Multi-tasking	1.611	0.0259	P3	1.778	0.0868	P2	0.167	
	Problem Solving	1.99	0.5636	P1	2.963	0.1882	P1	0.973	
2.	Extension Skills	2.076	0.1483	3	2.830	0.0737	3	0.754	-12.06**
3.	Communication / ICT	2.104	0.1711	2	2.602	0.1870	6	0.498	-6.817**
4.	Technical	1.952	0.1488	4	2.814	0.2949	4	0.862	-9.041**
5.	Managerial	2.117	0.0566	1	2.928	0.0542	1	0.811	-14.649**
6.	Market / Understanding Government Policy	1.745	0.1340	6	2.783	0.0355	5	1.038	-14.971**
7.	Entrepreneurial	1.862	0.1306	5	2.898	0.0463	2	1.036	-20.734**
	Total Mean	1.928			2.683			0.755	

R=Ranking of the competencies according to the calculated mean. M*= Mean difference calculated by desired status mean – existing status mean, ES=Existing Status, DS=Desired Status, M=Mean, SD=Standard Deviation*

The data in Table 1 shows the comparison of the mean of existing and desired status of the market competency. The difference in these means were tested with *Z*-test of equality of means and was found to have a significant difference between the means. It was found that the existing status (*M*=1.745; *SD*=0.1340) of the market competency was found to be lower than the total mean of the existing status of the various competencies together which suggested that there is a low competency regarding market knowledge and understanding of government policies. As for the desired level, the mean (*M*=2.783; *SD*=0.0355) was found to be higher than the existing status as well as the total mean of the desired level of the competencies. The results indicate that the students' knowledge and understanding of market and government policy are very low although the calculated mean is more than the total mean. They severely lack in the knowledge of markets and their functioning for agricultural commodities and lack basic accounting skills (ex. Balance sheets, income statements, cost benefit analysis, profit and loss, etc.). They were also found to have low knowledge of various sources of market information such as market places, prices of various crop in different markets along with different price support policies and government subsidies on various inputs in agriculture sector. This lack of knowledge indicated that the students passing higher educational system need to develop market competency which would enable them to help the farmers in getting the best for the crop produced by them.

As shown in the Table 1, the existing status mean (*M*=2.104; *SD*=0.1711) of the students communication competencies is higher than the low total mean. Although the calculated existing status mean shows an acceptable level of communication skills, the level of communication skills especially like fluency in English, written communication, ability to raise point of view in a gathering, ability to create and send emails and ability of writing good proposals for obtaining funds for research/business need to be improved. Concerning the desired level of communication competencies needed according to the farmers and industrial needs, the results revealed that the desired status mean (*M*=2.602; *SD*=0.1870) was a bit higher when compared to existing level. Accordingly, communication competencies such as fluency in Punjabi, patient listening, ability to operate Microsoft office, ability to use different audio-visual aids for information sharing and ability to present idea amongst a group of people were felt as the most important competencies desired.

After a vigorous review of literature and various competency models and methodology, five major personal competencies were identified. The students were asked to indicate their perceptions on these competencies which was measured in scales in terms of existing and desired status. As presented in the Table 1, the total mean of the existing status (*TM*=1.644) revealed that the students felt that they had a relatively satisfactory level of personal competencies needed. The results about the desired personal competencies needed according to farmers and industrial needs indicate that the following are seen as the most appropriate ones: problem solving, multi-tasking, team spirit, professionalism/work ethics and leadership.

The students were asked to rate the level of competence in their professional area and to designate their level of competence for each item of personal competencies. Means and standard deviations were used to describe the levels of competence. It was found that problem solving was found as the most important (*M*=2.963; *SD*=0.1882) under personal competencies while the leadership as the least important one (*M* =1.577; *SD*=0.2777). Line managers don't like hiring graduates who will come running every time they're out of their depth. If you can step up with a solution, you'll stand a better chance. Problem solving is a vital skill in daily life, which is why graduate employers are so keen on it. Even when it isn't specified in the job description, many employers will look at your problem-solving skills at various different stages of the application process. This could be anything from psychometric tests to group activities or one-to-one interviews. Problem solving is all about using logic, as well as imagination, to make sense of your situation and come up with an intelligent solution.

The second most important competency under personal competency was found to be multi-tasking (*M*=1.778; *SD*=0.0868). In the age that we live in, working professionals need to get a large number of inevitable tasks accomplished within the limited set of working hours they have. Focusing only on one task could equate to lower productivity levels which most organizations regard as unacceptable. This means that every individual needs to execute more than one task at the same time or to say 'Multitask'! Multitasking has its own set of pros and cons.

However, it is also beneficial if done in the correct way. It is not only crucial for students to be able to multitask well but also to do that in a smart and collaborative way. During discussions, it was found that students feared that doing multiple task at one time may degrade the quality of work but at the same it is the need of the hour looking at the scenario of employability in an organisation.

Team spirit with a mean of 1.692 and *SD* of 0.3065 was found to be the next important personal competency after multi-tasking. Organisations are much more likely to perform well when their people work effectively as a team. This is because good teamwork creates synergy – where the combined effect of the team is greater than the sum of individual efforts. Working together in a team can apply individual perspectives, experience and skills to solve complex problems, creating new solutions and ideas that may be beyond the scope of any one individual. As well as enhancing organisations' performance good teamwork benefits individuals too. It enables mutual support and learning, and can generate a sense of belonging and commitment. These skills also help in identifying leaders among the whole lot. They further perceived that the external appearance play a significant role in The students also mentioned the benefits of working together in terms of applying a mix of skills that go beyond the scope of any one individual, solve complex problems that take more than one mind, generate new ideas, coordinate individual activities towards a common bigger goal, provide support and help to team members, give people a sense of belonging, enhance communication, help people to learn from each other and develop and generate commitment convincing the customers. The students perceived that sometimes the deadlines to submit a project may be compromised if good quality projects are required but generally the projects should always be completed in the given time limit.

After the team-spirit the professionalism / work ethics competency was found at the fourth place on the basis of calculated mean and standard deviation (*M*=1.631; *SD*=0.2256). The students opined that they should look at a problem logically and not emotionally, its good to empathise with the problem but not to get too much attached with it.

At last but not the least, the leadership competency was found to have the last important personal competency as desired by the students with the calculated mean of 1.577 and standard deviation of 0.2777. There is a high expectation that the leader should be competent in the assigned task or specialty the one being supervised. This expectation exists to some level in all endeavours. On discussions with students on various indicators of leadership, it was found that some opined that they lack specific skills to mediate or solve conflicts and influence people to work in particular direction while others opined that it was easy for them to do so. They revealed that it was easy for them in performing and doing a task rather than monitoring or delegating a task as some times its difficult for them to continuously keep an eye on everything. The positive thing they revealed was that they would own a failure as leader in a group task if the task is failed due to some group members.

It is therefore difficult to say that one particular competency (out of the seven) is important than the other. The findings of various research studies indicated that in each categories of these competency as well as the categories were rated high and relevant than the rest according to demand of these competencies. This can be implied that when agricultural students or graduates lacks competencies, the entire agriculture sector suffers, and the long run effect is that rural or community development will be hampered, and the living standard of people in general will be low. However, the degree of application of these competencies will vary in relation to the area of usage. The analysis of data has showed that competencies in the area of personal skills, communication/ICT and technical knowledge dominates in most competency frameworks.

3.2 Farmers Perception of Existing and Desired Higher Agricultural Education Competencies

A brainstorming session was conducted with the farmers and during the session the farmers were asked to score the existing status and desired status of the higher agricultural education competencies present in the agri-students pertaining to their needs. The findings of Table 2 revealed that there was a totally different perception of the farmers regarding these competencies than what was revealed earlier in the results from the students. The following

agricultural competencies as perceived by the farmers for the desired status were ranked individually according to their calculated mean which indicated their importance in the descending order viz. technical (*M*=4.442), entrepreneurial (*M*=4.385), market/understanding government policy (*M*=4.438), managerial (*M*=4.435), communication/ICT (*M*=4.428), extension skills (*M*=4.422) and personal (*M*=4.285) competency.

The first rank of technical competency in the desired status of higher agricultural competencies clearly depicts that the farmers wanted the students to be well versed in the technical knowledge of agriculture. The farmers mentioned that the students are not able to answer to their queries or problems when they visit their fields. This lack of technical knowledge hampers the interaction between the farmers and the students.

Alike the students, farmers also ranked the entrepreneurial competency on the second position in the desired status of the higher agricultural competencies. The results in Table 2 clearly reveal that the in the changing times, everyone wants to have their own business to earn good profits. The farmers mentioned that the students with good entrepreneurial skills can help them form groups and guide them in forming

their own enterprise which would help them gain more profit for their products.

The market competency acquired the third position in the desired status with a mean of 4.438 and a standard deviation of 0.4973. The farmers mentioned that the agri-students should possess good market skills where they can help the farmers to identify the product, markets for those products, marketing channels, etc. The students need to help the farmers in eliminating the middlemen so that the farmers get the maximum percentage share in the consumers' price of the product. The farmers also mentioned that a good market competency would include understanding and knowledge of marketing agricultural products, knowledge regarding different markets and prices of different crops and knowledge of policies regarding input prices and government subsidies on these inputs.

The fourth, fifth, sixth and seventh position were acquired by the managerial, communication, extension skills and personal competency respectively. The farmers mentioned that the students were hesitant communicating with them in the fields. The farmers were found to be least concerned with the personal competency possessed by the students as they mentioned that it was there for their own personal development and concerned less with the needs of the farmers.

Table 2. Farmers perception of existing and desired higher agricultural education competencies (n=70)

S. no.	Competencies	ES (M)	ES (SD)	R*	DS (M)	DS (SD)	R*	M*	Z - Score
1.	Personal	2.504	0.8149	4	4.285	0.6720	7	1.781	-13.612**
	Leadership	2.52	0.8071	P3	4.414	0.5377	P2	1.894	
	Team Spirit	2.614	0.7856	P1	4.386	0.5721	P4	1.772	
	Professionalism / Work Ethics	2.586	0.9097	P2	3.776	1.2149	P5	1.19	
	Multi-tasking	2.4	0.6974	P4.5	4.407	0.5350	P3	2.007	
	Problem Solving	2.4	0.8748	P4.5	4.442	0.5003	P1	2.042	
2.	Extension Skills	2.379	0.8232	6	4.422	0.5186	6	2.043	-31.761**
3.	Communication / ICT	2.576	1.0243	3	4.428	0.5056	5	1.852	-9.076**
4.	Technical	2.695	0.9241	1	4.442	0.5074	1	1.747	-6.217**
5.	Managerial	2.407	0.7187	5	4.435	0.5118	4	2.028	-20.286**
6.	Market / Understanding Government Policy	2.233	0.8054	7	4.438	0.4973	3	2.205	-47.578**
7.	Entrepreneurial	2.617	0.7989	2	4.385	0.5627	2	1.768	-24.238**
	Total Mean	2.487			4.405				

R=Ranking of the competencies according to the calculated mean. M*= Mean difference calculated by desired status mean – existing status mean, ES=Existing Status, DS=Desired Status, M=Mean, SD=Standard Deviation*

4. CONCLUSION

As inferred by mean score of the desired status, the managerial competency was identified to be the most needed one among the agricultural graduates as perceived by the students followed by entrepreneurial, extension skills, technical, market/understanding government policy, communication/ICT and personal competency. The farmers identified the following competencies as desired in an agricultural graduates were in the order viz. technical, entrepreneurial, market/ understanding government policy, managerial, communication/ ICT, extension skills and personal competency. Attachment of students to entrepreneurs' viz. beekeepers, hybrid seed producers, vegetable growers, mushroom growers, baby corn producers for practical experience in the actual situations. They should work with these entrepreneurs as intern and their evaluation should be done by these entrepreneurs. Care should be taken that every student should be individually attached so that all of them get an opportunity to express themselves and a fair evaluation can be done. Agricultural sector development can only occur when an important number of agricultural graduates are available to undertake research, address issues affecting the agricultural and rural development sector, provide new and appropriate technologies and break new ground for future economic growth. New and innovative programs must be developed and commitments established to increase the human and institutional capacities of India's growing agriculture sector. Agricultural education has to be made more practical and rural realities oriented while agricultural extensions courses should be tuned to serve the needs of the rural community through dynamic interaction with rural societies.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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