



## Impact of skill development trainings on fish farmers' knowledge and attitude: A case study from Bihar, India

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### ABSTRACT

Skill development training aims to impart new knowledge and skill as well as build up favourable attitude among trainees. Evaluating the farmers' knowledge and attitude towards skill development trainings will help to assess effectiveness of training as well as adoption probability of the acquired knowledge/skill. This research paper evaluated the impact of skill development training on fish farmers' knowledge and attitude, in different districts of Bihar. Primary data were collected from randomly selected trainees (250 Nos.), using feedback proforma and mobile phonic survey methodology. The first three levels of training evaluation model given by Kirkpatrick and Kirkpatrick were followed for measuring the immediate impact of skill development training. Data were subjected to descriptive and Z-test statistics. The findings revealed that skill development training had significant ( $p=0.000$ ) positive impact on the knowledge level of trainees. They exhibited favourable attitude towards skill development trainings and would be potential adopters of the acquired knowledge and skills.

Keywords: Attitude, Fish farmers, Impact evaluation, Kirkpatrick model, Knowledge, Skill development training

### Introduction

Freshwater aquaculture sector has been identified as the fastest growing Agri-food production sector having massive potential of doubling farmers' income and providing food and nutritional security. Freshwater aquaculture has become the predominant source of fish protein (Toufique and Belton, 2014; Golden *et al.*, 2017). India's potential for marine fish production is only 4.5 million t by exploiting 80% of the resources and it cannot be stretched much more (FAO, 2016). The Government of India has also implemented the Blue Revolution Scheme with the aim of increasing fish production to 15 million t by 2020. India's current fish production is 13.70 million t of which 65% is from inland sector and almost 50% of this is contributed by culture fisheries (The Economic Times, 2019). Presently, doubling farmers' income by 2022 is one of the top priorities of the Government. Therefore, encouraging freshwater aquaculture could be the best potential option for achieving targeted production and income, but hard to accomplish without well-trained and skilled workforce. Recent studies also indicated that investments in new production systems, management practices and skill development result in considerable increase in production and income (Kumar and Engle, 2016; Kumar *et al.*, 2018).

Aquaculture production is mainly constrained by lack of good quality seed and feed, low technical capacity, weak

market and value addition, inadequate extension services and materials, poor management of culture systems and low capacity in disease diagnostics (Rothuis *et al.*, 2014; Kaminski *et al.*, 2017). Skill development is becoming equally important, like other factors of production as fish farming is becoming more skill-intensive, technology-driven and inert-linked with allied economic activities. Lack of skill or knowledge among farmers may result in low productivity. Past studies also proved that skill development training for farmers yielded positive results. Murshed-E-Jahan and Pemsil (2011) reported that capacity building of fish farmers through training is more worthwhile than providing financial support. Tripp *et al.* (2005) also confirmed that training contributed significantly to enhance farmers' skill and knowledge. A farmer's attitude is also considered as an essential factor as it determines what and how he learns and how he adopts it (Dey *et al.*, 2010; Wetengere, 2011; Kumar *et al.*, 2018). Attitude has a crucial role in influencing farmer's goals and behaviour. Behavioural change is a pre-requisite for technological adoption, which is mostly governed by attitude (Ndah *et al.*, 2011; Wandji *et al.*, 2012; Olatunji and Nwaogwugwu, 2013; Olaoye *et al.*, 2016). Therefore, ensuring positive attitudinal changes among farmers is one of the effective ways to achieve desired production and income targets. Khairul and Kamariah (2011) reported that training provided to the farmers not only improved their knowledge, skill and attitude but also boosted their morale

and motivation resulting in better performance. Studies on the effectiveness of training for farmers showed that most of the training programmes in developing countries failed due to excessive concentration on a particular technology transfer rather than a broader spectrum of farmer empowerment including knowledge dissemination (Yang *et al.*, 2008; Oreszczyn *et al.*, 2010). However, these gaps could be overcome by carefully revising and designing the skill development training, which can facilitate to achieve desired productivity and income.

The present study was carried out to evaluate the impact of Skill Development Training (SDT) entitled “Mithe Pani Me Machhali Palan (Freshwater Aquaculture)” on fish farmers’ knowledge and attitude. These SDTs are aimed at capacity building and enhancing competencies (knowledge, skill and attitude) of fish farmers to improve their farm productivity and profitability. Though these SDTs are organised with the primary objective of enhancing knowledge and skill of farmers, to what extent it has been achieved needs to be evaluated.

### Materials and methods

As per available database of trainees, a total 723 farmers were trained under SDT Program from nineteen districts (Darbhanga, Sitamarhi, Purnea, Kishanganj, Supaul, Madhepura, Aurangabad, Araria, Katihar, Banka, Jehanabad, Gaya, Bhojpur, Buxar, Saharsa, East Champaran, West Champaran, Vaishali and Siwan) of Bihar State, at Kolkata Centre of ICAR-Central Institute of Fisheries Education (ICAR-CIFE), during August 2016 to December 2019 and they were considered as the population for the study. Primary data were collected during December 2019 to January 2020 from the selected trainees. The criteria followed for selecting the sample of trainees were: those who possessed mobile phones and those who completely filled the feedback proforma during training. A list of 580 farmers distributed across different districts of Bihar State were collected and from this, 250 respondents were selected by simple random sampling.

The pre-tested knowledge test, feedback proforma and structured interview schedule were used to collect the information from respondents in three steps. Step 1 - the pre-training knowledge test was conducted on the first day of the training; Step 2 - the post-training knowledge test was conducted and the feedback forms were filled by trainees on the last day of training and Step 3 - mobile phone interviews were conducted with selected trainees to obtain the required information. Kirkpatrick and Kirkpatrick (2006) model of four levels of training evaluation *i.e.* reactions, learning, behaviour and result were followed. The first three levels were considered for measuring the immediate impact of training on trainees which mainly

dealt with trainee’s immediate reactions about training, perceived usefulness of training, difficulties in training and extent of acquired knowledge and skills. The knowledge outcomes were measured by pre-training and post-training assessment using the same knowledge test consisting of 15 multiple choice questions. The possible maximum and minimum scores were 15 to 0, respectively. The pre and post-knowledge scores for all the respondents were calculated. Based on pre and post-knowledge scores, the respondents were categorised into very low, low, medium, high and very high categories using the cumulative square root of frequency method. The attitudinal changes were evaluated using 15 structured statements on three continuums *viz.*, *Agree (A)*, *Uncertain (UC)* and *Disagree (DA)* with a score of 3, 2 and 1, respectively. The mean attitude score for each respondent was calculated. Based on mean attitude scores, the respondents were categorised into very less, less, medium, high and very high categories using Cumulative Square Root of Frequency (CSRFF) method suggested by Dalenius and Hodges (1959) and Cochran (1977). The CSRFF method was applied using *strata.cumrootf* function available in *stratification-package* of R 4.0.2. The collected data were subjected to descriptive and Z-test statistics to draw meaningful conclusions.

#### *Cumulative square root of frequency method*

All the respondents were categorised into very low, low, medium, high and very high categories using the CSRFF method as it allows greater efficiency for setting stratum boundaries. It breaks down the population into intervals, which can be of equal or unequal width. The steps involved in its calculation are: Evaluate the data and determine the units that can be reviewed on an actual basis. Then stratify the remaining data into ranges or classes. The number of classes and class interval is determined using the following formulae:

$$\text{Number of classes} = 2.5 * (\text{Number of samples})^{1/4}$$

$$\text{Class interval} = \frac{(\text{Largest figure} - \text{Smallest figure})}{\text{Number of classes}}$$

Further, the frequency for each range was calculated, which is the number of units within the range and then the square root of the frequency for the first range was calculated. Then the square root of the next range was calculated and this process was continued for each of the ranges. Sum of the square root of the first and second range gives the cumulative square root of the second range; the sum of first, second and third gives the third range and so on for all the ranges. The cumulative square root frequency value of the last class is divided by the number of sample strata desired (can vary 3-9) to get the cumulative square root value for each item. We desired to

have 5 strata and then the upper limit of the first strata is determined using the formula:

$$L_i = Y_{i-1} + \frac{(Y_i - Y_{i-1})}{\sqrt{f}} * \left\{ \left( \frac{S_k}{L} \right) * 1 - S_{i-1} \right\} \dots\dots\dots(1)$$

where,  $L_i$  = Upper limit of the  $i^{th}$  strata (In this case first strata);  $L$  = Number of strata;  $Y_i$  = Upper limit of the class in which  $L_i$  lies;  $Y_{i-1}$  = Lower limit of the class in which  $L_i$  lies;  $S_k$  = Cumulative square root frequency value;  $\sqrt{f}$  = Square root of the frequency of the  $i^{th}$  class in which  $L_i$  lies;  $S_{i-1}$  = Cumulative square root frequency of the preceding class in which  $L_i$  ( $S_k/L$ ) lies and  $Y_i - Y_{i-1}$  = Width of the class in which  $L_i$  ( $S_k/L$ ) lies.

For the upper limit of second strata, the formula is:

$$L_i = Y_{i-1} + \frac{(Y_i - Y_{i-1})}{\sqrt{f}} * \left\{ \left( \frac{S_k}{L} \right) * 2 - S_{i-1} \right\} \dots\dots\dots(2)$$

Formula for the upper limit of third strata:

$$L_i = Y_{i-1} + \frac{(Y_i - Y_{i-1})}{\sqrt{f}} * \left\{ \left( \frac{S_k}{L} \right) * 3 - S_{i-1} \right\} \dots\dots\dots(3)$$

Formula for the upper limit of fourth strata:

$$L_i = Y_{i-1} + \frac{(Y_i - Y_{i-1})}{\sqrt{f}} * \left\{ \left( \frac{S_k}{L} \right) * 4 - S_{i-1} \right\} \dots\dots\dots(4)$$

Formula for the upper limit of fifth strata:

$$L_i = Y_{i-1} + \frac{(Y_i - Y_{i-1})}{\sqrt{f}} * \left\{ \left( \frac{S_k}{L} \right) * 5 - S_{i-1} \right\} \dots\dots\dots(5)$$

In this way, five strata were formed *i.e.*, below value 1, between value 1 and value 2, between value 2 and value 3, between value 3 and value 4 and above value 4 up to value 5.

**Results and discussion**

*Profile characteristics of the respondents*

The age of farmers was considered as an important variable to measure the percentage of youth participating in skill development training. The detailed profile of trainees in Table 1 demonstrates that the majority (70.40%) of trainees were young. Young farmers are coming forward to participate enthusiastically in skill development training due to the promotion of freshwater aquaculture through subsidies and skill development by Bihar State Government. The support from the government attracts them towards fish farming which has the potential of providing assured income and employment throughout the year.

About 96.80% of trainees were male. As the trainings were conducted at Kolkata City, the long-distance and long training duration might have constrained women farmers from Bihar State to participate actively in SDTs. It is implied that as women are the major workforce in agriculture

Table 1. Profile of the trainees who attended the skill development trainings (n = 250)

Variables	Category	Frequency	Percentage
Age	Young (<=35 years)	176	70.40
	Middle (36-50 years)	53	21.20
	Old (>51 years)	21	8.40
Sex	Male	242	96.80
	Female	8	3.20
Education	Primary (1-4 standard)	4	1.60
	Secondary (5-10 standard)	101	40.40
	Higher secondary (11-12 standard)	50	20.00
	Graduation	84	33.60
Caste	Post-Graduation	11	4.40
	Scheduled tribes	27	10.80
	Scheduled caste	29	11.60
	Other backward class	123	49.20
	General	71	28.40

and allied sectors, the Bihar State Government should have plans to train farm women as well by considering women friendly training place, time and personnel at their respective districts or nearby areas. It was gratifying to note that the significant numbers of trainees were educated upto secondary (40.40%) followed by graduation level (33.60%). The educated youths were targeted which could be the win-win situation, as it is encouraging freshwater aquaculture production and addressing unemployment through skill development among the youth. Almost half (49.20%) of the trainees belonged to other backward class (OBC) followed by general (28.40%), scheduled caste (SC) (11.6%) and scheduled tribes (ST) (10.8%).

*Pre and post-training knowledge levels of trainees*

It can be seen from Table 2 that out of 250 trainees, majority (68.80%) had very low (28.80%) to low (40%) level of knowledge before the training while only 14% of trainees had low level of knowledge after the training. About 29% trainees had high level of knowledge before the training, while 36.40% of the trainees had high level of knowledge after the training. None of the trainees were found in the category of very high level of knowledge before the training but it increased to 13.60% after the training. The 'Z' test analysis between pre-training mean knowledge score (7.90) and post-training mean knowledge score (11.80) clearly indicated that SDTs had a significant (p=0.000) positive impact on knowledge level of trainees. These results were in line with the findings of Godase *et al.* (2011) and Tayade and Chinchmalpure (2016).

*Attitude level of trainees after attending SDTs*

Farmers' attitude about any developmental activity is a priceless resource to policymakers for designing or

Table 2. Pre and post-training knowledge levels of trainees (n=250)

Knowledge level	Score range	Pre-training		Post-training		'Z' value (p-value)
		Frequency	Percentage	Frequency	Percentage	
Very low	<=6	72	28.80	0	0.00	16.689* (p=0.000)
Low	7-9	100	40.00	35	14.00	
Medium	10-11	49	19.60	90	36.00	
High	12-14	29	11.60	91	36.40	
Very high	>14	0	0.00	34	13.60	
Mean		7.90		11.80		
Standard deviation		3.04		2.10		

\*Significant at 0.05 level

modifying policies in order to achieve desired outcomes. To a great extent, the ultimate decision to apply learnt skill or knowledge depends on the farmers' attitude towards it. Rahman (2003) and Wei *et al.* (2007) also opined that farmers' attitude controls farmers' decision making and reflects farmer's adoption behaviour related to any farm technology.

Almost half of the trainees exhibited high (34.40%) to very high (14.80%) level of favourable attitude towards SDTs (Table 3) who would be potential adopters of learnt knowledge and skills. On the contrary, about 23.60% trainees showed a medium favourable attitude followed by less favourable attitude (17.20%) towards SDTs.

Certainly, host institutions need to re-think about enriching the training content in order to convert trainees' less favourable attitude to more favourable attitude towards SDTs which would ultimately contribute to their improved adoption and performance at farm level. These findings were in line with the findings of studies conducted by Singh *et al.* (2009), Khairul and Kamariah (2011), Olatunji and Nwaogwugwu (2013), Sahare *et al.* (2017) and Sharma *et al.* (2017).

Table 4 indicates that perceived behavioural changes had the highest mean score (2.82) followed by perceived immediate reactions (2.60) while perceived applicability had the lowest mean score (2.45). It reveals that the farmers had a more favourable attitude towards behavioural changes than applicability of training. Therefore, factors responsible for their less favourable attitude towards the applicability of training need to be investigated and addressed for improving the quality of

SDTs. Under perceived immediate reactions component, level of easiness of training content to understand, had the lowest mean score (2.29) indicating a less favourable attitude towards it. This might be due to excessive use of technical jargon rather than simple language which farmers can understand. Under perceived applicability of training component, performance of farm operations in faster and better way (2.08) and expansion farm business network (2.10) had lowest mean scores representing less favourable attitude of trainees towards them. This implies that the SDTs should focus more on practical aspects (*how to do*) of fish farming as well as techniques of marketing and business expansion in future. Under perceived behavioural changes component, the lowest mean score (2.18) of training/guiding to fellow farmers represented less favourable attitude. This might be due to lack of confidence for teaching/guiding to fellow farmers or competition among farmer trainees. This implies that the training should also focus on the personality development of farmers along with economic and social aspects of fish farming so that the trained farmers could play the role of change agent or key informants for encouraging sustainable and profitable fish farming.

#### *Prioritising suggestions given by trainees to strengthen SDTs*

The suggestions given by the trainees were prioritised and presented in Fig. 1. The most prioritised suggestion was that the information on central and state government schemes for promoting fish farming (87.50%) must be provided during training followed by an increase in the number of practical exposure visits related to fish farming

Table 3. Overall attitude level of trainees after attending skill development training (n=250)

Degree of favourableness	Score range	Frequency	Percentage
Very less	<=2.45	25	10.00
Less	2.46-2.57	43	17.20
Medium	2.58-2.65	59	23.60
High	2.66-2.76	86	34.40
Very high	>2.77	37	14.80

Mean: 2.62; Standard deviation: 0.15

Table 4. Component and respective item-wise mean attitude score of trainees (n=250)

Components and respective items	Percentage			Items		Components	
	A	UC	DA	Mean	SD	Mean	SD
A. Perceived immediate reactions after training							
1. I found training more informative and enjoyable	84.80	12.40	2.80	2.82	0.45	2.60	0.14
2. I found training to be useful to great extent	61.20	34.00	4.80	2.56	0.59		
3. I found training content easy to understand	50.80	27.60	21.60	2.29	0.80		
4. I found training facilities more adequate and comfortable	67.20	21.60	11.20	2.56	0.69		
5. I found knowledge and skills of trainers satisfactory	78.00	18.00	4.00	2.74	0.52		
B. Perceived applicability after training							
6. I found the acquired knowledge and skills compatible to my farming needs	82.80	14.80	2.40	2.80	0.45	2.45	0.35
7. I found the acquired knowledge and skills easy to apply	79.20	20.80	0.00	2.79	0.41		
8. I can perform farm operations in faster and better way	35.60	37.20	27.20	2.08	0.79		
9. I would certainly increase my farm production and income	64.40	20.00	15.60	2.49	0.75		
10. I would expand my farm business network	32.80	44.80	22.40	2.10	0.74		
C. Perceived behavioural changes after training							
11. I would certainly attend such kind of skill development trainings in future	100.00	0.00	0.00	3.00	0.00	2.82	0.36
12. I feel more motivated to do profitable fish farming	100.00	0.00	0.00	3.00	0.00		
13. I would motivate fellow farmers to do profitable fish farming	92.40	7.60	0.00	2.92	0.27		
14. This kind of skill development trainings should be given to all fish farmers	100.00	0.00	0.00	3.00	0.00		
15. I would teach/guide my fellow farmers	49.60	19.20	31.20	2.18	0.88		

Note: A- Agree; UC- Uncertain; DA-Disagree; SD- Standard deviation

(79.17%) especially to successful aquapreneur's farms. Follow-up training with same trainees (75%) was assigned third rank and this is mainly for addressing the fish farming issues and updating them on current developments. The training should be conducted in March or April month of the year (70.83%) so that they can observe functioning of hatcheries during exposure visits, gain practical information on preparation and marketing of fish value added products (54.17%); on fish disease identification and management (45.83%) and demonstration of biofloc technology (41.67%) were suggested by more than half of the trainees for strengthening skill development trainings and sustaining their impact at field level.

Freshwater aquaculture has immense potential for enhancing fish production and farmers' income but to harness this potential, skilled farmers' workforce is essential. The ICAR-CIFE, Kolkata is striving hard to impart skills among fish farmers since its inception by organising SDTs. The present work was undertaken to study the impact of these SDTs on fish farmers' knowledge, attitude and skill. The study revealed that majority of educated young farmers got the opportunity to undergo training in different aspects of fish farming. The study found that women farmers' participation in SDTs was negligible. Women being significant workforce in agriculture and allied sectors, the state Government should encourage participation of women by offering structured training programmes suited to them. The study of STDs reveals the positive and significant impact on the knowledge and attitude of trainees. However, it is suggested that factors responsible for less favourable

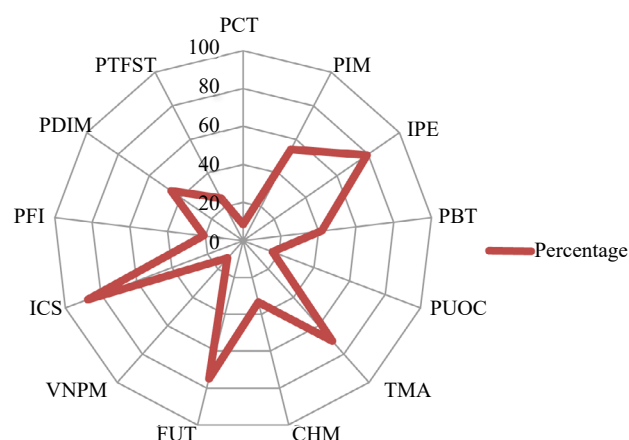


Fig. 1. Prioritisation of trainee's suggestions to improve SDTs. PCT-Demonstration on pearl culture technique; PIM-Practical information on preparation and marketing of fish value added products; IPE-Increase of number practical exposure visits related to fish farming especially to successful aquapreneur farms; PBT-Practical demonstration on biofloc technology; PUOC-Practical on how to use and operate cast net in ponds; TMA-Training should be conducted in March or April month of the years to observe running hatcheries; CHM-Complete hatchery management practices; FUT-Follow up training should be conducted with same trainees; VNPM-Visit to net and plankton net markets; ICS-Information on central and state government schemes for promoting fish farming; PFI-Practical demonstration on how to give injection to fish; PDIM-Practical demonstration on fish disease identification and management; PTFST-Precautions and techniques of fish seed and fish transportation.

attitude of trainees towards the applicability of training are to be investigated and addressed for improving the quality of SDTs. The present study deals with only the first three levels of training evaluation model *i.e.* reactions, learning and behaviour given by Kirkpatrick and Kirkpatrick (2006). Hence, it is recommended to conduct further studies to evaluate fourth level *i.e.* results to understand broader social, economic and environmental impacts of SDTs on fish farmers' livelihood.

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