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Revisiting Kirkpatrick Model for assessing the impact of the training on inland ornamental fisheries management

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Abstract

The present study aimed to assess the impact of the trainers' training programme on "Inland ornamental fisheries management for income Generation", organised by the Guwahati Regional Centre of ICAR-Central Inland Fisheries Research Institute (ICAR-CIFRI), by constructing a composite training impact index based on four-stage model of Kirkpatrick. The index was developed by conducting two factor analyses for "Reaction" and "Learning-Behaviour-Result" stages. Total 15 variables were reduced into six factors, namely, Quality, Utility, Need gratification, Overall grading, Change in Knowledge-Attitude-Skill (KAS) and Result. The average composite index score of all trainees was found to be 72.92% and around 57% of the respondents fell in the "very high" category regarding the impact of the training. Around 42.86% respondents graded the training programme as excellent. Wilcoxon Signed Rank test showed significant change in knowledge and attitude among the trainees at 5% level of significance. Around 66.67% had taken some action after going back and the obtained KAS was extended to 110 fishers who were sensitised or trained on inland ornamental fishery management practices. The study presents a comprehensive scenario about the impact of the training programme on the trainees by digging deep into the final outcome level rather than restricting to only immediate reaction level. The devised composite index can be useful for researchers and academicians of other institutes working on human resource development for measuring the impact of similar types of programmes.

Introduction

In the backdrop of intense effort of the policy makers for doubling income of the farmers in agriculture and allied fields in India, inland fishery sector assumes humongous potential to uplift the income of the poor rural communities of the country. There lies tremendous untapped potential for entrepreneurship development in various arenas of inland fisheries sector. One such highly potential and profitable area is inland ornamental fisheries. Ornamental fishes are often called as 'living jewels' and characterised by a wide diversity of colours and patterns (Ramamoorthy *et al*., 2010). Around 400 species of ornamental fishes belonging to 175 genera and 50 families are found in Indian waters (Satheesh, 2002). India can make its niche in the global export market of ornamental fishes and earn a huge amount of foreign exchange. Apart from foreign exchange, they can generate job opportunities for the rural poor. However, Rameshan and Shaktivel (2015) opines that despite being a multi-million-dollar industry, the industry is yet poorly studied and has received very little attention. India too has huge scope for improving its status regarding culture, conservation and trade of ornamental fishes. India's share in global trade is only ₹15 crores, which is very insignificant compared to its potential. The trade is dominated by freshwater ornamental fishes (90%) (Raja *et al*., 2014). Therefore, there is sheer need for developmental efforts to upscale ornamental fisheries in the country, which can be achieved through proper dissemination of information and transfer of

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technology. The people associated with this need to be empowered with knowledge and capacity for culture, breeding, conservation and marketing of ornamental fishes both in domestic and export market. In order to reach the end users, the officials working at the grassroots level need to be made aware and empowered through training as well as capacity building for further dissemination of the required information and also to motivate rural mass for entrepreneurial ventures with ornamental fisheries. Training helps to enhance organisational efficiency through changes in the capacity of the trainees (Templeton, 2009). Training of trainers extends an opportunity to develop basic instructional skill of the trainers, which enable them for effective contribution in their field for developing skills and knowledge among the clientele groups. On this backdrop a five days Training of Trainers programme was organised at the Guwahati Research Centre of ICAR-Central Inland Fisheries Research Institute (ICAR-CIFRI) for the officials working in state departments and other organisations on "Inland ornamental fisheries for income generation". Twenty-one officials from Assam, Manipur and Madhya Pradesh participated in the training programme. The present study was undertaken with the objective of assessing the impact of the training programme by developing suitable methodology.

Lynton and Pareek (1978) have suggested three phases of an effective training programme *viz.,* (a) pre-training need assessment; (b) training and (c) post-training evaluation follow up. The last stage demands special attention for further improvement of training programme and to measure the areas of strengths and weaknesses of the trainer organisation. If the efficacy of training in terms of practical outcomes is not established, staff may be inappropriately utilised and resources may be wasted (Smidt *et al*., 2009). However, training evaluation is probably the weakest and most under-developed aspect of training (Topno, 2012). However, there is no universal guideline for training programme evaluation. There are different models to evaluate training. However, Kirkpatrick model (1998) is probably the most well-known framework for classifying areas of evaluation (Phillips, 1991). The model comprises four levels, namely reaction, learning, behaviour and results (Smidt, 2009). The government invests billions to enchance the capacity and development of the human resources. However, studies on impact or practical output of these capacity building programmes are limited. Since Kirkpatrick model measures impact from the initial reaction to changes in learning and behaviour to the final result, this model was chosen for the present study to devise the measuring framework. Impact assessment of the trainings should focus on quantifying the training outcomes. In the present study, an attempt was made to devise a composite index for assessing impact of training based on Kirkpatrick Model.

Materials and methods

Realising the potential of ornamental fisheries for income generation of fishermen community, the Guwahati Regional Centre of ICAR-Central Inland Fisheries Research Institute (ICAR-CIFRI) organised a five days long trainers' programme on "Inland ornamental fisheries management for income Generation", for 21 trainees. The present study aimed to assess the impact of this trainers' training programme, for which a total of fifteen variables were selected based on literature survey and expert consultation. Out of these ten were for measuring impact at "Reaction" level, two for "Learning" level, one for "Behaviour" level and two for "Result" level (Fig. 1). Data were collected from twenty-one trainees both before and after the training programme through semi-structured interview questionnaire and also through telephonic interview.

Knowledge test

A knowledge test was developed with the help of item collection and item analysis to assess the knowledge level of officials before and after the training programme. For item collection, important aspects regarding ornamental fisheries were listed in consultation with experts working in the domain and review of literature. The difficulty index for an item was worked out as the percentage of respondents giving right answer to an item. The items for which the percentage ranged from 30 to 80 were considered for the selection in the final knowledge test.

Attitude test

The initial set of statements aiming to measure attitude towards ornamental fisheries were presented to thirty experts who were asked to express the relevancy of the statement in a five-point continuum rating scale. Simple frequency and percentage was also used to describe the variable. For the variables like The Relevancy, Extent of Satisfaction and Quality of the training sessions were measured on three-point continuum rating scale. Sessions were ranked based on the average scores.

Composite index development

Since it is difficult for the researchers and policymakers to comprehend the results of fifteen variables, attempt was made to bring out a composite training impact score that was accomplished by applying Principal Factor Analysis. In the present study, two separate factor analyses were conducted, one for ten "Reaction" variables and the other for five "Learning-Behaviour-Result" variables and two corresponding separate composite indices were developed. For each index, weighted factor scores were used, in which number of factors was determined on the basis of total variance (%) explained by the factors and weight was determined on the basis of variance explained by each factor.

Final score in index: After calculating the scores of individual components of a respondent, the total score for each respondent for both "Reaction" and "Learning-Behaviour-Result", was obtained by the following formula as adapted by Malakar *et al.* (2018):

$$FS_{jk} = \sum_{i=1}^{s} L_{ij} X_{ik}$$

FS_{jk} = Score of component j for respondent k;

L_{ij} = Factor loading coefficient of j^{th} component of i^{th} variable;

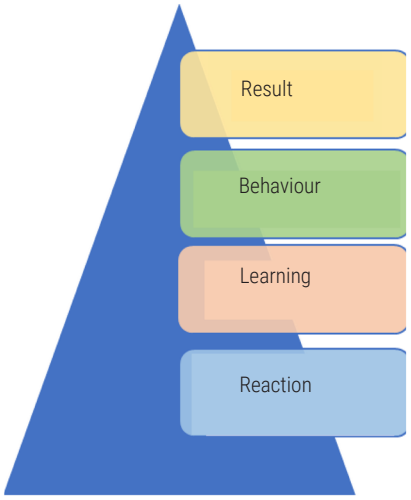
X_{ik} = Score of variable i for respondent k;

s = Number of variables;

$$I = \sum_{i=1}^{m} (v_j / v_t) \times FS_{jk}$$

I = Composite Score Index;

v_j = Variance explained by component j;



Variables studies	Tools of measurement	Method of data collection
1. On the Job application	Open ended questions	Telephonic interview
2. Reach to farmer		
1. Change in attitude	5-point Likert type Attitude Scale	Interview schedule
1. Change in knowledge	Pre-Post Knowledge test	Interview schedule
2. Change in skill	5-point rating scale	Telephonic interview
1. Expectation fulfilment	3-point rating scale	Feedback schedule
2. Relevancy	3-point rating scale	Feedback schedule
3. Usefulness	3-point rating scale	Feedback schedule
4. Satisfaction	3-point rating scale	Feedback schedule
5. Quality	3-point rating scale	Feedback schedule
6. Scope for interaction	Yes=1, No=0	Feedback schedule
7. Ease level	3-point rating scale	Feedback schedule
8. Facility and resources	3-point rating scale	Feedback schedule
9. Method and atmosphere	3-point rating scale	Feedback schedule
10. Grading	5-point rating scale	Feedback schedule

Fig. 1. Variables and their measurement in each level of Kirkpatrick model

v_t = Total variance explained by m components;

m = Number of components selected.

After calculating the individual index values, the composite index scores were calculated by taking the arithmetic mean of the two index scores, and thereafter it was normalised to express the scores in % between the range of 0 to 100. Normalisation was done based on the following formula:

Normalised score: (X-Min value)/ (Max value-Min value)

Final Composite Training Impact Index Score: [Normalised score of {(R+ LBR)/2}] * 100

R = Composite Score Index of "Reaction"

LBR = Composite Score Index of "Learning-Behaviour-Result"

Results

At the first phase, attempt was made to analyse the individual variables under each level of Kirkpatrick's model in detail to come out with a comprehensive picture. The variable-wise findings are presented below.

Reaction

"Quality"

The Relevancy, Extent of Satisfaction and Quality of the training sessions were measured on three-point continuum rating scale. Sessions were ranked based on the average scores which are presented in Table 1.

"Utility"

Usefulness: Around 47.62% found the sessions to be highly useful followed by 37.33% who found the sessions to be moderately useful.

Satisfaction with training methodology and atmosphere: Most of the respondents were highly satisfied with training atmosphere (76.19%), training methods (85.71%), competency of trainers (61.9%), mode of lecture delivery (80.96%), programme schedule (80.96%) and ease of understanding (57.14%). Around 52 and 42% were moderately satisfied regarding duration and practical orientation of the training programme respectively. The trainees suggested to increase the duration of training, lecture delivery in local language, better lodging facilities and more practical sessions for future improvement of the training programme.

Ease of attending the training programme: Most of the respondents (90.48%) expressed no confusion, good management, no difficulty in understanding the contents and interesting sessions. Around 80.95% stated that sessions were based on their training need and 61.90% stated comfortable environment. Around 42.86% opined that training sessions were more of routine theory to some extent and 38.1% stated difficulty in availing permission from their respective authorities to participate in the programme.

"Need gratification":

Extent of interactivity of the training sessions: Six out of twenty-one (28.57%) respondents stated that there was not enough

Table 1. Relevancy, extent of satisfaction and quality of the training sessions

Topics	Relevancy		Satisfaction		Quality	
	Avg. score	Rank	Avg. score	Rank	Avg. score	Rank
Ornamental fish culture and trade: An overview	2.67	II	2.76	II	2.67	II
Water quality management for freshwater ornamental fishes	2.81	I	2.71	III	2.57	III
Conservation of inland ornamental fishes	2.14	X	2.29	X	1.90	X
Nutrient requirement of ornamental fish and feed technology	2.48	IV	2.52	VI	2.10	IX
Live feed for ornamental fishes and its culture	2.24	VII	2.67	IV	2.24	VIII
Collection and rearing of indigenous ornamental fishes	2.43	V	2.43	VIII	2.48	IV
Diseases of ornamental fish and its management	2.67	II	2.81	I	2.43	V
Indigenous ornamental fish: breeding and culture	2.43	V	2.76	II	2.76	I
Breeding of exotic ornamental fishes	2.57	III	2.67	IV	2.67	II
Practical on setting up an aquarium	2.29	VIII	2.24	XI	2.38	VI
Aquarium fabrication and maintenance	1.90	XI	2.19	XII	1.81	XI
NFDB schemes for development of ornamental fisheries	2.19	IX	2.33	IX	1.67	XII
Field visit to Amranga Ornamental Fish Breeding Unit	2.19	IX	2.48	VII	2.38	VI
Role of NABARD in development of inland fisheries	2.14	X	2.43	VIII	2.29	VII
Aquatic ornamental plants and their culture	1.81	XII	2.29	X	2.10	IX
Maintenance of data and record keeping	2.57	III	2.62	V	2.76	I
Practical on estimation of water quality parameters	2.33	VI	2.52	VI	2.38	V

scope for discussion and rest 15 stated that there was enough scope. Most of the respondents (47.62%) opined that practical activities could improve more interaction in the sessions. The suggested means to improve interaction were reducing lecture time, prior course material, application of case study method, demonstration, participatory approach and Computer Based Learning (CBL).

Fulfillment of expectation: Majority (61.9%) stated that their expectation was fulfilled to a great extent followed by 38.1% was of the opinion that it was fulfilled to some extent. In a study conducted by Roy *et al.* (2019), 54% trainees expressed fulfilment of expectation to a great extent in a model training course conducted at ICAR-CIFRI, Barrackpore and 50% graded the programme as excellent.

"Overall grading":

Satisfaction with facilities, resources and training methodology: Respondents expressed their extent of satisfaction with the facilities, resources and training methodology in a 3-point continuum rating scale. Majority of the respondents were moderately satisfied with lodging (66.67%), boarding (57.14%) and recreation (52.38%). Forty seven per cent were highly satisfied with food and 38% were highly satisfied with classroom, laboratory and library facilities.

Overall grading of the training programme by the trainees: Around 42.86% respondents graded the training programme as excellent and another 42.86% graded as very good followed by 14.28% who graded the programme as good.

Learning-Behavior-Result

"Change in KAS"

Change in Knowledge and Attitude: Wilcoxon Signed Rank test showed significant difference between pre-training and post-training knowledge level of respondents at 5% level of significance (Z= -4.018, p=0.000). Mean score was found to be 78.57% after training which was 53.33% before training. Most of the trainees fell in medium category (66.67%) before training while majority fell in high category (57.14%) after training (Fig. 2).

Regarding attitude level also, Wilcoxon Signed Rank test was applied and significant difference between pre-training and post-training attitude level of respondents was noticed at 5% level of significance (Z= -4.015, p=0.000). Around 57% fell in neutral attitude before training while after training 50% fell in favourable attitude category followed by 36.36% in neutral category (Fig. 3).

Perceived Skill Gain: Since it was not feasible to test the extent of skill gain of the trainees after training programme, they were asked to perceive their own skill gain on a 5-point continuum rating scale over telephonic interview. More than 40% (42.87%) perceived skill gain to satisfactory extent followed by 38. 08% who stated they gained skill to a great extent and rest 19.05% stated that they gained skill to a moderate extent. The perceived areas of skill development are presented in Table 2.

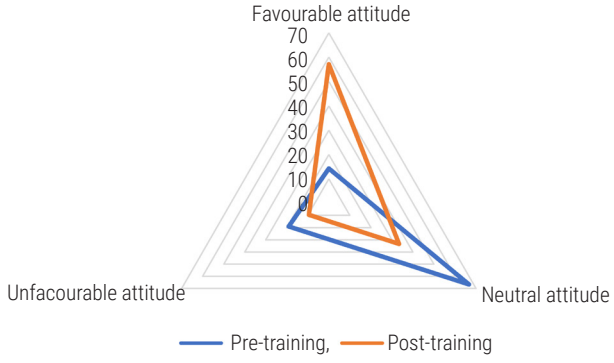


Fig. 2. Change in knowledge: Wilcoxon Signed Rank test

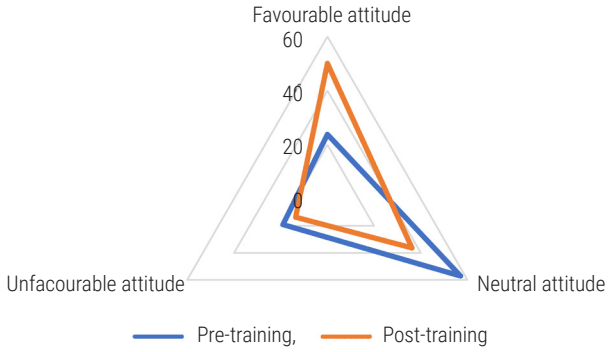


Fig. 3 Change in attitude: Wilcoxon Signed Rank test

Table 2. Areas of skill development

Areas of skill development (N=21)	Percentage
Ornamental fish culture	28.57
Water quality testing	9.52
Feed management	19.05
Aquarium management	9.52
Hatchery management	9.52
Fish disease control	38.09
Breeding of exotic ornamental fish	28.57

Results

Action taken and number of end users reached: Open ended questions were asked over telephonic interview regarding the actions that the participants had taken after going back to their respective institutes. A score of 1 was given for information sharing with fellow colleagues, 2 was given for informal interaction with fishermen or fish farmers or other relevant stakeholders, 3 was given for establishment of physical unit for ornamental fisheries/ carrying out physical activities regarding ornamental fisheries like breeding, culture or conservation. A score of 4 was given for formal training/ demonstration/ interactive session and mass awareness campaign for fishermen or fish farmers. A score of 5 was given for activities leading to visible fishermen's benefit**.** About 66.67%of the participants had taken some action after the training programme (Table 3). A total number of 110 fishermen or fish farmers were reached, however no information on fishermen's benefit could be elicited.

Developing index for measuring impact of training programme: Since comprehending findings of fifteen variables is cumbersome, a composite training impact index was formulated in the next stage to present a concise result. The steps followed are mentioned below:

Step 1 - Conducting factor analysis: Four components were extracted through principal component method in case of "Reaction" and two components were extracted in case of "Learning-Behaviour-Result". The scree plot (Fig. 4 and 5) as well as Table 4 and 5 explain the fraction of total variance in data represented by each component. In case of "Reaction" around 90% variance could be explained by four components while for "Learning-Behaviour-Result" around 64% variance could be explained by two extracted components.

Table 3. Action taken by the participants at respective Institutes

Action	Frequency (N=21)	%
Information sharing with fellow colleagues	2	9.52
Informal interaction with farmers/dealers	6	28.57
Stocking of ornamental fish	2	9.52
Breeding of ornamental fish	2	9.52
Training/Demonstration of farmers	2	9.52

Step 2 - Grouping indicators (variables) into factors (components): The rotated component matrix demonstrates the loadings (beta values) which explain contribution of each variable to the components. Based on loadings of variables to a particular component (factor), the components are given a name to represent the group of variables that have major contribution to that particular component (factor). The extracted factors are presented in Table 6 and 7. By factor analysing "Reaction" variables, four factors could be extracted namely, "Quality", "Utility", "Need gratification" and "Overall Grading" and two factors could be extracted namely, "Change in KAS" and "Result" out of "Learning-Behaviour-Result" variables.

Table 4. Percentage of total variance explained in "Reaction" by components

Component	Eigen value	% of Variance	Cumulative %
1	3.832	38.324	38.324
2	2.476	24.759	63.083
3	1.666	16.660	79.742
4	1.063	10.630	90.373
5	.536	5.356	95.728
6	.292	2.924	98.652
7	.110	1.102	99.754
8	.024	.238	99.992
9	.001	.008	100.00
10	.000	.000	100.00

Table 5. Percentage of total variance explained in "Learning-Behaviour-Result" by components

Component	Initial Eigen values		
	Total	% of Variance	Cumulative %
1	1.935	38.697	38.697
2	1.258	25.159	63.856
3	.849	16.988	80.844
4	.713	14.266	95.111
5	.244	4.889	100.000

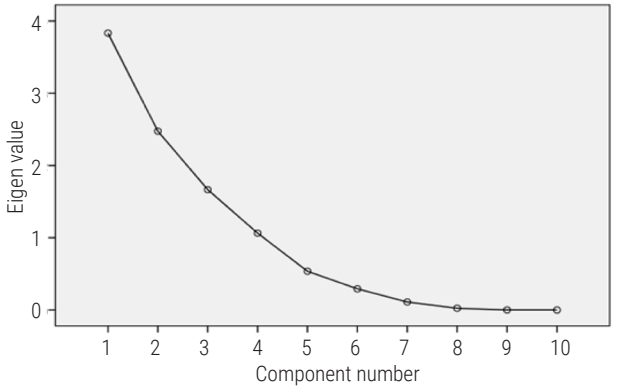


Fig. 4. Screeplot showing contributions of components w.r.t. eigen values for "Reaction"

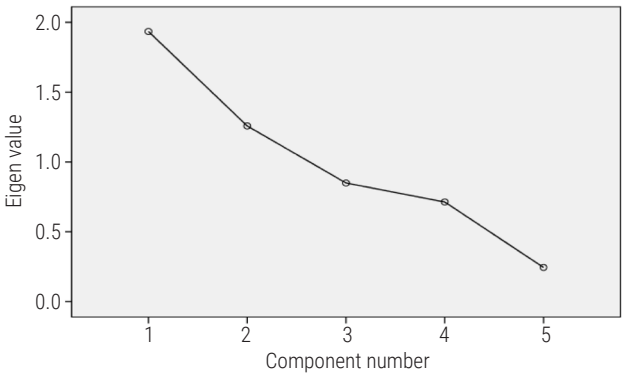


Fig. 5. Screeplot showing contributions of components w.r.t. eigen values for "Learning-Behaviour-Result"

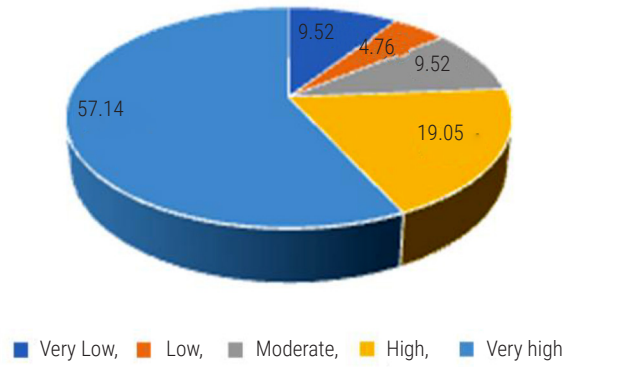


Fig. 6. Categorisation of respondents based on final composite index score (N=21)

The mean training impact score of the all trainees was found to be 72.92% using the composite training impact score. Around 57% of the respondents fell in the "very high" category (Fig. 6).

Discussion

Training effectiveness refers to the benefits that the organisation and the trainees receive from training which may include learning new skills or behaviour. Effectiveness of the training programme is an essential indicator of terminal evaluation which helps to assess the usefulness of training by the implementing organisation as well as to the donors (Roy *et al.,* 2018). However, most evaluations of these capacity building programmes restrict only to the immediate reaction stage (Gordon and Chadwick, 2007). In the present study, attempt has been made to use Kirkpatrick's four level model to construct a composite training impact index and also to analyse each variable separately. Jonny (2016) attempted to evaluate the effectiveness of Kirkpatrick Model and Return on Investment of Training at PT XYZ which is known as one of the largest and reputable companies in Indonesia. In a study to measure effectiveness of call centres in India, Rehmat *et al*. (2015) applied Kirkpatrick Model. The present study attempted to cover all four levels of Kirkpatrick Model and devised a composite index based on that. This study attempted to measure the impact of training with a single index score in light of Kirkpatrick Model. The summary of the study is presented in Fig. 7.

Realising the importance of ornamental fisheries for income generation and livelihood security, ICAR-CIFRI organised a five days 'Training of Trainers'. The present study attempted to assess impact of the training programme by devising a composite training impact index in light of Kirkpatrick Model. In the present study

Table 6. Contribution of variables to the rotated components extracted from Factor analysis for "Reaction"

Variables	Rotated Component Matrix				Component name
	Component				
	1	2	3	4	
Relevancy	.846	-.134	.215	.278	Quality
Satisfaction	.889	-.202	-.037	.324	
Quality	.845	.484	-.122	.184	
Usefulness	.507	.672	.215	-.216	Utility
Training method	.063	.889	-.014	.275	
Level of ease	-.352	.874	.257	-.089	
Expectation fulfilment	.111	.042	.901	.327	Need gratification
Scope for interaction	.069	.207	.831	-.318	
Grading	.297	.123	-.002	.926	Overall grading
Facilities and resources	-.257	.088	.491	.754	

Table 7. Contribution of variables to the rotated components extracted from factor analysis for "Learning-Behaviour-Result"

Variables	Rotated Component Matrix		Component name
	Components		
	1	2	
Action taken	.927	-.043	Result
Number of fishermen reached	.908	-.110	
Change in knowledge	-.218	-.706	Change in KAS (Knowledge-Attitude-Skill)
Change in attitude	-.136	.627	
Change in skill	-.267	.683	

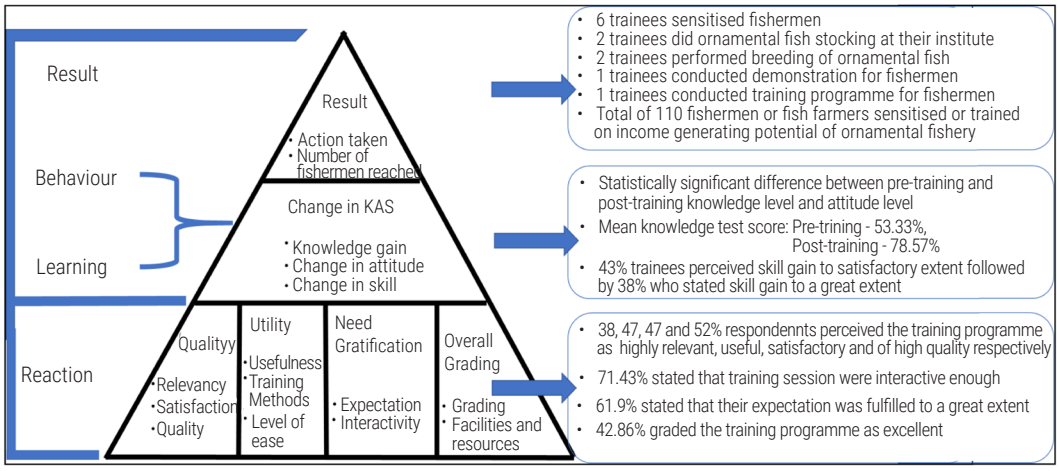


Fig. 7. Summary of the present study

authors have attempted to dig deep into the change in KAS and final outcome of the training programme. It is imperative to assess the impact of the training and development programmes to justify the financial investment and to gather feedback on the course curricula. Therefore, systematic impact assessment of the training programmes will form a strong base for higher funding to overcome many local, regional and national problems regarding ornamental fisheries as well as inland fisheries development. The study gives a comprehensive idea about the effectiveness and outcomes of the training programme justifying the cost and effort put for the same. The devised composite index can also be used to assess impact of similar type of training programmes in future by other institutes as well for those involved in human resource development. The study may suggest that, customising content to the participant's needs and relevance, directly applicable to the learners' job roles may improve training effectiveness. Training objectives may also link to key professional outcomes of the trainees to enhance the effectiveness of the training programmes. Using advanced training methodology, *i.e.* by blending of methods, the training classes can be made more fruitful and effective. By focusing on all four levels of the Kirkpatrick Model, the effectiveness of the training programmes can be systematically improved.

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