



INTERDISCIPLINARY RESEARCH AND ITS IMPACT ON LEARNERS' ATTITUDE

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ABSTRACT

Interdisciplinary research helps to turn bi-modal nature of phenomenon into success as interdisciplinary research ensures the synergy between two contrasting modes or forms. However, students' attitude to interdisciplinary research has not been analysed. The purpose of the contribution is to analyse students' attitude to interdisciplinary research underpinning elaboration of a hypothesis on ensuring students' positive attitude to interdisciplinary research within university studies. The meaning of the key concepts of "interdisciplinary research" and "students' attitude" is studied. Moreover, the logical chain of analysis is shown: interdisciplinary research → students' attitude → empirical study within a multicultural environment. Directions of further research are proposed. The novel contribution of the paper is the notion and phases of interdisciplinary research worked out by the paper's authors.

Keywords: *Interdisciplinary Research, University Studies, Students' Attitude, Emotions*

1. INTRODUCTION

High-priority issues of today, such as world hunger, biomedical ethics, sustainable resources, homeland security, and child development and learning, and pressing research questions, such as the evolution of virulence in pathogens and the relationship between biodiversity and ecosystem functions, as well as advances in science and engineering increasingly require the collaboration of scholars from various fields. This kind of collaboration is known as interdisciplinary research. Interdisciplinary research serves as a means of scientific investigation of bi-modal phenomena. By bi-modal phenomenon, a phenomenon that obtains or exhibits two contrasting modes or forms is meant. Interdisciplinary research helps to turn bi-modal nature of phenomenon into success as interdisciplinary research ensures the synergy between two contrasting modes or forms.

The feature of interdisciplinary research to turn bi-modal nature of phenomenon into success promotes the shift in the focus on the room of the implementation of interdisciplinary research. The room of interdisciplinary research changes from research projects carried out by experienced researchers to the synergy between research carried out by experienced researchers within projects and research done by students within university studies. Success of students' participation in interdisciplinary subjects was assessed through formative and summative evaluations. However, students' attitude to interdisciplinary research has not been analysed.

The purpose of the present contribution is to analyse students' attitude to interdisciplinary research underpinning elaboration of a hypothesis on ensuring students' positive attitude to interdisciplinary research within university studies. The meaning of the key concepts of *interdisciplinary research* and *students' attitude* is studied. Moreover, the analysis demonstrates how the key concepts are related to the idea of *emotions* and shows a potential model for development, indicating how the steps of the process are related following a logical chain: interdisciplinary research → students' attitude → empirical study within a multicultural environment. Our empirical results were obtained within MANIT, Bhopal, India, in January 2015. The novel contribution of this paper is the definition of the notion and phases of *interdisciplinary research* worked out by the paper's authors. The remaining part of this paper is organized as follows: Section 2 introduces the definition of interdisciplinary research as well as students' attitude. The associated results of the empirical study will be presented in Section 3. Finally, some concluding remarks are provided in Section 4 followed by a short outlook on interesting topics for further work.

2. THEORETICAL FRAMEWORK

Interdisciplinary research has been variously defined since 1920 when the earliest documented use of the term *interdisciplinary* in research appeared in the social sciences . Since then, the definitions of interdisciplinary research are not static, they are in a state of process, change and development.

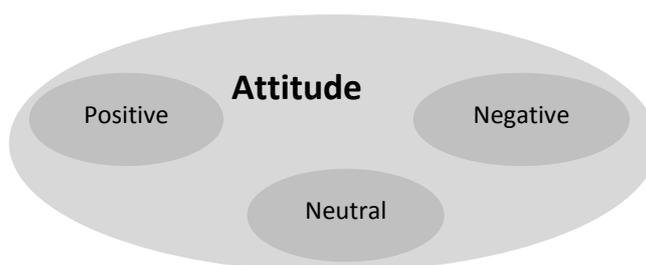
Analysis reveals that a primary focus of the ongoing debate over the meaning of interdisciplinary studies or inter-disciplinarity concerns integration . Integration literally means "to make whole" . In the context of interdisciplinarity, integration is a process by which ideas, data and information, methods, tools, concepts, and/or theories from two or more disciplines are synthesized, connected, or blended. Therein, the focus in interdisciplinary research is put on its procedural aspect. Consequently, interdisciplinary research is defined to be the process. Therein, the notion of interdisciplinary research is defined by the paper's authors as shared aim oriented joint activity or, in other words, process according to certain common norms, over some period of time that provides knowledge variety through joint social interaction and cognitive activity and increases opportunities of

creating new knowledge. Table 1 reveals a detailed description of three phases of the process of interdisciplinary research.

Table 1: *Phases of the process of interdisciplinary research*

Component of the process of interdisciplinary research	Feature of the process of interdisciplinary research			
	Phases of the process of interdisciplinary research	Content in the process of interdisciplinary research	Form of the process of interdisciplinary research	Reflection
Preparation	Phase 1 comprises making previous experience rational, creating the system of the aim and objectives, searching for a variety of information sources, obtaining techniques of information compiling	Existing concepts or existing knowledge	Social interaction or frontal activity	Some reflective operations necessary for task implementation
Activity	Phase 2 is aimed at - planning the process of interdisciplinary research, including the choice of forms and use of resources, -implementation of the process of interdisciplinary research with exchange of activity's forms and methods, - enrichment of the process of interdisciplinary research	Quasi-concept or knowledge variety	Peer-interaction or peer-learning	Reflection as a source of co-operation and communication, ability to coordinate different positions and initiate joint activity
Evaluation	Phase 3 claims participants' self-regulation with use of process assessment and result self-evaluation	New concept or new knowledge	Cognitive activity or learning	Reflection as a source of self-awareness, ability to change yourself and determine own capacity

Interdisciplinary research is measured by such a criterion as attitude. Attitude is identified as a combination of evaluative judgments about a phenomenon. Traditionally, attitude is differentiated into positive, neutral or negative as illustrated in Figure 1.



Differentiation of attitude

Attitude is rooted in emotions. Thus, emotions and attitude are inter-related, although emotions refer to psychology, and attitude – to pedagogy. Therein, psychological processes provide the basis for pedagogical developments.

Emotions defined as nerve impulses ensure this faster reaction to a problem situation as emotions encourage for acting by use of an immediate plan of action . The main thing is that emotional processes and states have their own special positive development in man . Therein, it is widely believed that men and women differ in their emotional responding. The positive development of emotional processes and states must be especially emphasized in as much as the classical conceptions of human emotions as "rudiments" coming from Darwin. In pedagogy, experience includes knowledge, skills and attitude. Further on, emotions are relevant to the social activity and not to individual actions or operations that realize it. As a result emotions are not subordinated to activity but appear to be its result and the "mechanism" of its movement. For the cultural dimension of the process of interdisciplinary research, it is important that the experience and expression of emotions is dependent on learned convictions or rules and, to the extent that cultures differ in the way they talk about and conceptualize emotions, how they are experienced and expressed will differ in different cultures as well . Consequently, taking into consideration the discipline culture, as emotional practitioners, students can make the process of interdisciplinary research exciting or dull. Moreover, students' interactions can be crucial in developing students' academic self-concept and enhancing their motivation and achievement . Thereby, on the one hand, emotion reflects the culture trait of a person, and, on the other hand, the emotions are social constructions .

3. EMPIRICAL RESEARCH

The present part of the contribution demonstrates the design of the empirical research, survey results and findings of the research.

3.1. RESEARCH DESIGN

The design of the present empirical research comprises the purpose and question, sample and methodology of the present empirical study.

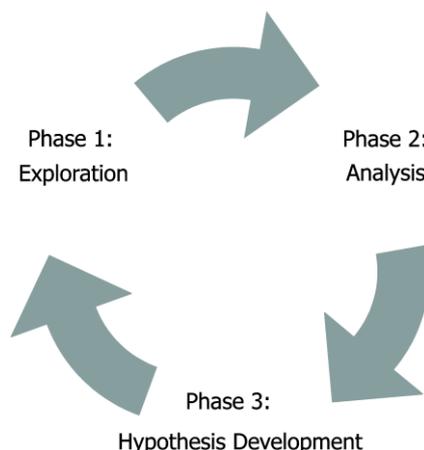
The empirical study was aimed at analyzing students' attitude to interdisciplinary research. The research question was as follows: what is students' attitude to interdisciplinary research?

The present empirical study involved 13 second-year B.E students of MANIT, Bhopal, India, in December 2015. The sample included 7 male and 6 female students. The age of students ranged between 20 and 22. All the students obtained working experience in different fields of

business. Although the students studied in the same group, they represented different cultures. Therefore, the sample is multicultural as the respondents with different cultural backgrounds and diverse educational approaches were chosen. Students' different cultural and educational experience emphasized the significance of each student's contribution to the analysis of the attitudes to interdisciplinary research. Thus, the group's socio-cultural context (age, cultural and educational experience, mother tongue, etc.) is heterogeneous.

The interpretative research paradigm which corresponds to the nature of humanistic pedagogy has been used in the present study. Interpretative paradigm is characterized by the researcher's practical interest in the research question. Researcher is the interpreter.

Explorative research has been used in the empirical study. Explorative research is aimed at developing hypotheses, which can be tested for generality in following empirical studies. The explorative methodology proceeds as demonstrated in from exploration in Phase 1 through analysis in Phase 2 to hypothesis development in Phase 3. Phase 1 *Exploration* is aimed at data collection. Phase 2 *Analysis* focuses on data processing, analysis and data interpretation. Phase 3 *Hypothesis Development* ensures analysis of results of the empirical study and elaboration of conclusions and hypotheses for further research.



Methodology of the explorative research

3.2. SURVEY RESULTS

In order to analyse the students' feedback regarding their attitude to interdisciplinary research, the survey was based on the following questionnaire:

Question 1: Please, indicate your gender. The evaluation scale of two levels was created where "1" meant "male", and "2" represented "female".

Question 2: Do you know the concept of interdisciplinary research? It should be noted that concepts present forms or levels of knowledge. Further on, knowledge is part of experience . The evaluation scale of five levels for Question 2 was given, namely, strongly disagree “1”, disagree “2”, neither disagree nor agree „3“, agree “4”, and strongly agree “5”.

Question 3: What is your attitude to interdisciplinary research? The evaluation scale of five levels for Question 3 was given, namely, very negative “1”, negative “2”, neither negative nor positive „3“, positive “4”, and very positive “5”. Both evaluation scales were transformed into the level system as illustrated in Table 2.

Table 2: Indicators and levels of students’ attitude to interdisciplinary research

Indicators	Levels				
	Level 1	Level 2	Level 3	Level 4	Level 5
	very low	Low	average	Optimal	High
	1	2	3	4	5
Students’ knowledge of the concept of interdisciplinary research	<i>Strongly disagree</i>	<i>Disagree</i>	<i>Neither disagree nor agree</i>	<i>Agree</i>	<i>Strongly agree</i>
Students’ evaluative judgment about interdisciplinary research	<i>Very negative</i>	<i>Negative</i>	<i>Neither negative nor positive</i>	<i>Positive</i>	<i>Very positive</i>

The results of Question 1 (Gender), Question 2 (Concept) and Question 3 (Evaluative judgment) of the questionnaire used in the survey are demonstrated in Figure 3 where the vertical numbers show five levels to measure students’ attitude to interdisciplinary research, and the horizontal numbers present the code number of the student who participated in the survey.

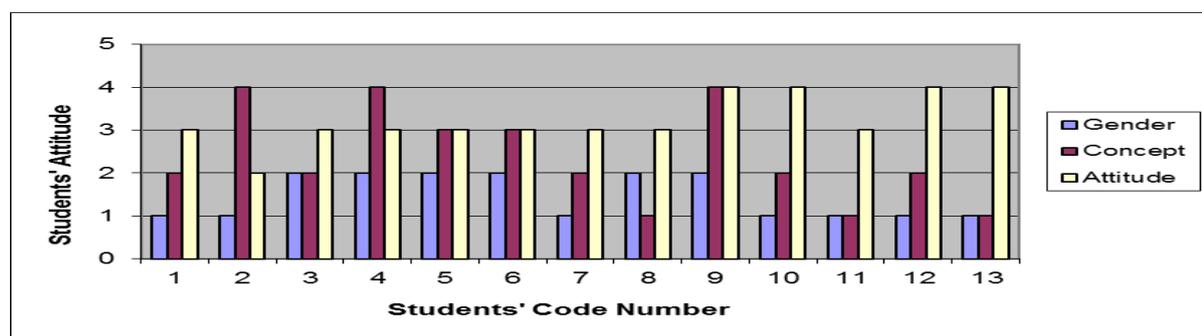


Figure 3: The results of Question 1 (Gender), Question 2 (Concept) and Question 3 (Evaluative judgment)

The results of Question 1 (Gender) of the questionnaire used in the survey show that the sample involved 7 male and 6 female students.

The results of Question 2 (Concept) reveal that

- 3 students' – 2 male and 1 female – evaluation of their knowledge of the concept of interdisciplinary research refers to the very low level,
- 5 students' – 4 male and 1 female – evaluation of their knowledge of the concept of interdisciplinary research refers to the low level,
- 2 students' – 2 female – evaluation of their knowledge of the concept of interdisciplinary research refers to the average level,
- 3 students' – 1 male and 2 female – evaluation of their knowledge of the concept of interdisciplinary research refers to the optimal level.

The results of Question 3 (Evaluative judgment) demonstrate that

- 1 student's – 1 male – evaluative judgment about interdisciplinary research refers to the low level,
- 8 students' – 3 male and 5 female – evaluative judgment about interdisciplinary research refers to the average level,
- 4 students' – 3 male and 1 female – evaluative judgment about interdisciplinary research refers to the optimal level.

3.3. FINDINGS OF THE RESEARCH

The data were processed applying *Excel* software.

Frequencies of the students' answers were determined in order to reveal students' attitude to interdisciplinary research as shown in Table 3.

Table 3: *Frequency of the students' answers*

Indicator	Levels	Number Of Answers	Gender	Number Answers Of By Gender	Percentage	Percentage By Gender
Students' Knowledge Of The Concept Of Interdisciplinary Research	Very Low	3	Male	2	23.07%	15.38%
			Female	1		7.69%
	Low	5	Male	4	38.46%	30.76%
			Female	1		7.69%
	Average	2	Male	0	15.38%	0%
			Female	2		15.38%
	Optimal	3	Male	1	23.07%	7.69%
			Female	2		15.38%
	High	0	Male	0	0%	0%
			Female	0		0%
Students' Evaluative Judgment	Very Low	0	Male	0	0%	0%
			Female	0		0%
	Low	1	Male	1	7.69%	7.69%

About Interdisciplinary Research	Average	8	Female	0	61.53%	0%
			Male	3		23.07%
	Optimal	4	Female	5	30.76%	38.46%
			Male	3		23.07%
	High	0	Male	0	0%	0%
			Female	0		0%

The survey showed that the students' knowledge of the concept of interdisciplinary research is of the low level (38.46%), particularly, male students (30.76%). The students' evaluative judgment about interdisciplinary research is of the average level (61.53%), particularly, female students (38.46%). Further on, the mean results determine the low level of the students' knowledge of the concept of interdisciplinary research (2.38), and the average level the students' evaluative judgment about interdisciplinary research (3.15) as shown in Table 3.

Table 3: Mean results

Indicator	Levels	Number of answers	Gender	Number of answers by gender	Mean	Mean gender by
Students' knowledge of the concept of interdisciplinary research	very low	3	male	2	2.38	Male
			female	1		
	Low	5	male	4		2.0
			female	1		
	Average	2	male	0		Female
			female	2		
	Optimal	3	male	1		2.83
			female	2		
	High	0	male	0		
			female	0		
Students' evaluative judgment about interdisciplinary research	very low	0	male	0	3.15	Male
			female	0		
	Low	1	male	1		5.28
			female	0		
	Average	8	male	3		Female
			female	5		
	Optimal	4	male	3		3.16
			female	1		
	High	0	male	0		
			female	0		

The findings of the empirical study allow concluding that the female students demonstrated a higher level of knowledge of the concept of interdisciplinary research (2.83), in comparison to the male students (2.0). As well as the male students revealed a higher level of positive evaluative judgment about interdisciplinary research (5.28), in comparison to the female students (3.16). The summarizing content analysis of the data reveals that the students' attitude to interdisciplinary research is of the average level.

4. CONCLUSIONS

The findings of the present research allow drawing conclusions on the average level of students' attitude to interdisciplinary research. Therein, there is a need for the increase of the level of students' positive attitude to interdisciplinary research.

The following hypothesis has been formulated: a level of students' positive attitude to interdisciplinary research increases if students are involved in carrying out a joint interdisciplinary research, a favourable educational (teaching, peer-learning and learning) environment for the enrichment of students' positive attitude to interdisciplinary research is organized, educational interaction between male and female students is increased that results in students' improved knowledge about interdisciplinary research.

The present research has limitations. The inter-connections between interdisciplinary research, students' attitudes and emotions have been set. Another limitation is the empirical study conducted by involving only the students of one higher education institution. Therein, the results of the study cannot be representative for the whole area. Nevertheless, the results of the research – the notion and phases of interdisciplinary research and levels of students' attitude to interdisciplinary research - may be used as a basis of analysis of students' attitude to interdisciplinary research in other institutions. If the results of other institutions had been available for analysis, different results could have been attained. There is a possibility to continue the study.

Further research tends to implement empirical studies in other institutions. The search for relevant methods for evaluation of students' attitude to interdisciplinary research is proposed. A comparative research of different countries could be carried out, too.

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