Enhancing Fusion Teaching based Research from the Student Perspective

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Abstract

There has been a growing need for fusion based research studies on the relations between university teaching and research. The higher educational universities of the current generation believe in and focus on the teaching-research nexus in academics. To improve teaching methodology there is more emphasis given to the fusion teaching by enabling the information fusing concept through pedagogy. Many discussions have been carried out to evaluate the contribution of teaching–research nexus from the student's point of view. The current study highlights teaching through research where the learners are taught with a special focus on research activities at the same time. The objective of this work is to promote fusion of research related activities into the teaching and learning process to achieve positive impact on enhancing students' interest towards learning. In view of this and to support this, various opportunities were provided for students and teachers to conduct research and a strategic approach was implemented to achieve this objective. We explore a) student involvement in different scholarly activities b) analyse research skill acquisition of the experimental group c) collect feedback to find students satisfaction level on FTBR approach.The findings demonstrate (mean score 3.09) the positive contribution of the fusion research-teaching towards achieving academic excellence.The strategies discussed in the methodology and results of the study may be used to broaden the fusion teaching-research at the graduate and undergraduate levels.

Keywords: Fusion Teaching–Research Nexus; Information Fusion; Research Strategies; Learning, Education.

1. Introduction

All over the world, higher education systems face challenges resulting from their development, diversification, expansion, and questions concerning their social significance [29,30,31]. Over the past years, many perspectives on education have evolved. In this modern world, educational institutions are transforming education by incorporating research activities as part of fusion teaching to deepen student learning. However, the importance of the teaching–research remains vague [32]. At this point, it is important to understand that knowledge is not static or fixed and hence to deal with this rapid change a fusion approach of teaching and research is considered ideal. Implementation of research into academics is what makes universities stand out from other organizations. Furthermore, fusion of research adds a new dimension to teaching as it provides knowledge quest and interest among students. FTBR framework provides a fusion between the research activity and teaching activity, as well as fuses the department and their teaching activities.

Research-based fusion teaching is one of the key performance indicators that measure the excellence of an educational institution and fosters the development of new ideas and knowledge. It aids researchers to discover findings, applying their problem-solving ability to process the findings, enabling the information fusion pedagogy-methodology and contribute results to the knowledge of discovery. Although teaching and research

Doi: https://doi.org/10.54216/FPA.120209
Received: January 28, 2023 Revised: April 27, 2023 Accepted: June 27, 2023

support each other, various studies show that more value has been given to research compared to teaching in universities as research develops the ability to discover new knowledge. The fusion research approach in the curriculum benefits students and educators to improve their cognitive and pedagogy practices. Application of integrating good practises of fusion based research learning fosters student engagement and exploration skills and it needs trained fusion researchers as educators. The teaching of academicians not involved in research can be described as: repetitive, non-stimulating or obsolete. Fusion models are innovative and incorporate experimental learning strategies. It is a powerful approach based on the framework of applying learning experiences inside or outside classrooms.

FTBR approach aligns with 21st century learning skills. It promotes acquisition of skills such as deep learning, self-learning, and course engagement. It involves applying learning experiences inside or outside classrooms through research skills. Therefore, in this paper, data fusion is combined with research to enhance self-exploration skills among students. The study aims to expand students research competencies through activities related to research.

In this paper, section 2 is a literature survey, section 3 focuses on the fusion research framework and curriculum design, section 4 discusses the methodology, section 5 describes the results obtained and section 6 presents the conclusions and future study.

2. Literature Review

As per the American practice, both teaching and research (TR) co-exist in varying ways [33]. Narrative reviews on TR were more prominent during 2012 to 2017 [29] and systematic reviews prevailed during 2018 to 2022 [34,38,39,40]. Studies show that most of the review studies on TR were published by authors from the U.K. [33,37,38]. In modern context, this will support the Humboldtian ideal of fusing teaching and research among English education system [33]. The concept of teaching pedagogy in higher education identifies modes of methods used to enhance quality learning at post graduate level in university [34,37,38,39,40]. Studies reveal the stress caused on universities in implementing TR due to social changes [33,37]. Studies hypothesized TR nexus on its historical origin and the face of changes in TR nexus has due to changes in the education curriculum and technological developments [33,37]. It is widely accepted by researchers that the proper use of lesson plan is a key element of fusion of research integrity [42] and scholars have provided guidelines for TR teaching, experimental designs, and statistical procedures to back TR integration evidences [41,42].Papers reported effects of TR on students [39]: such as students' improved understanding of subjects, increased collaboration among peers, developing sense of responsibility, able to carry out tasks independently, developing interpersonal skills etc. Furthermore, another researcher [34] reported positive effects such as improving students' understanding of research work, interest in research, career options, building confidence, staying engaged in research-based activities. TR integration research studies also expand to wide horizon which include hospitality and tourism [44], social protection [43], health services etc. The learning models play an important role in academics. It gives a foundation and a layout to fuse different pedagogies such as using digital media into curriculum in an online technology platform [5].Studies have compared the traditional teaching mode vs. video teaching method and found no significant gain achieved in student performance with traditional method; whereas, fusion video teaching approach has not only increased students' interest towards learning, but also promote deep learning in higher level [28]. The experimental results comparing face-to-face vs. video fusion teaching reveal that the video teaching fusion approaches helped in not only mobilizing the enthusiasm but also in promoting students' performance in academics [28].

Studies reveal that in Economics teaching, less time can be invested for teaching and more time can be given to keep students fully engaged during the class to deepen knowledge and to create interest in learning important complex Economic issues [14].

Several debates are hypothesizing fusion between teaching and research. Studies reveal the positive approach to teaching-research relation. Teaching and research are mutually related to achieving academic excellence in the current education system. Research studies on student observation on staff research reveal a strong encouraging impact on students. Research studies reveal that maintaining proper teaching plans results in bringing competencies in generating knowledge [9]. Students were more enthusiastic and interested to learn from teachers having research backgrounds as it motivated them to develop curiosity and accept challenges along with their academic skills. This shows importance of trained research teachers in implementing fusion based research in academics. Studies have been carried out to analyse the benefits of the teacher as a researcher [10]. Research is important for universities as it educates students with general study skills and establishes foundation for various courses as well as builds scientific skills and explores knowledge [4]. Research teaching nexus is involved with research-informed and the level of incorporating it varies from subject to subject. It can be incorporated as project work in the final term where the project can be monitored by the advice [3]. Studies show that students

Doi: https://doi.org/10.54216/FPA.120209
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are more confident and motivated to be taught in a fusion research-led environment. Modern research works inspires students in learning through research. The involvement of students as research assistants in staff-led research motivates students in building their confidence in fusion research nexus. As opposed to traditional learning which is academic oriented; fusion research-led training system develops high order technical skills among students [11]. Many research studies have emerged to study the predominance of whether a teacher with a research background can innovate teaching strategies and student learning. Research studies have also been carried out to understand the protection of occupational stress and beliefs about the fusion teaching–research nexus. Undergraduate experiences of the research/teaching nexus across the whole student lifecycle [6] are analysed by scholars. Studies have been conducted to establish a relationship between teaching and research and results show that having a proper teaching plan contributes towards generating new knowledge. Studies reveal that the ability to research and find solutions develop when students do their final project [7]. Studies investigating the type of teaching-research nexus by examining the research projects and approach of the management in this regard. John Taylor in his research work has proposed a new model based on contextual factors to establish fusion between teaching and research [8].However, few research studies on fusion research-teaching uncover the negative link between teaching and research [2].Though research, grounds deep knowledge sometimes it is seen as affecting student learning and teachers' effectiveness to achieve classroom teaching goals as teachers are more occupied at researching. Although there are several debates on the results, current studies demonstrate the positive contribution of the fusion research-teaching nexus toward achieving academic excellence.

3. Research Framework

In fusion teaching-research, various research strategies are implemented in a systematic way to incorporate teaching practices to promote the research learning habits. Educators apply a research approach to their teaching to develop research skills of the students.

In this study, conventional approach is implemented to study the positive relationship between student's awareness and experiences about research and teaching. Research is conducted to evaluate students' awareness of research activities at university and students' experiences on research-learning nexus [1].

Research is incorporated in teaching and learning curriculum as follows in order to inculcate research habits among students.

- Including staff's research work into teaching so that students are more motivated about research.
- Guiding students to make connections between the various sections in the project works in a recognisable way.
- Including current/ongoing research work in the courses and by including the latest developments/findings in their field in the curriculum, thus creating a sense of discipline.
- Conducting debates and discussions as part of research and finding limitations in research that will help students to find out more questions as their research topic.
- Problem analysis and discussion of contemporary issues in research and allowing students to explore themselves cutting edge research from the fundamental knowledge gained in the class.
- Incorporating teaching research skills in curriculum and provide fundamental knowledge about research culture.
- Organising research activities as part of a project/assignment.
- Engaging students in short-term or long-term research assignments.
- Encouraging students in departmental research activities/projects
- Involving quick learning students as research assistants in research projects as part of course/departmental activity and value their contributions through grants/awards/scholarships.
- Sharing skills and experiences with researchers who pass out of the course.
- Publishing important research work/activities in website/newsletters
- Conducting workshops/seminars/conferences and encouraging student participation to make evidence-based research decisions.

Figure 1 depicts research framework that describe the fusion practices offered in teaching and research methodology.

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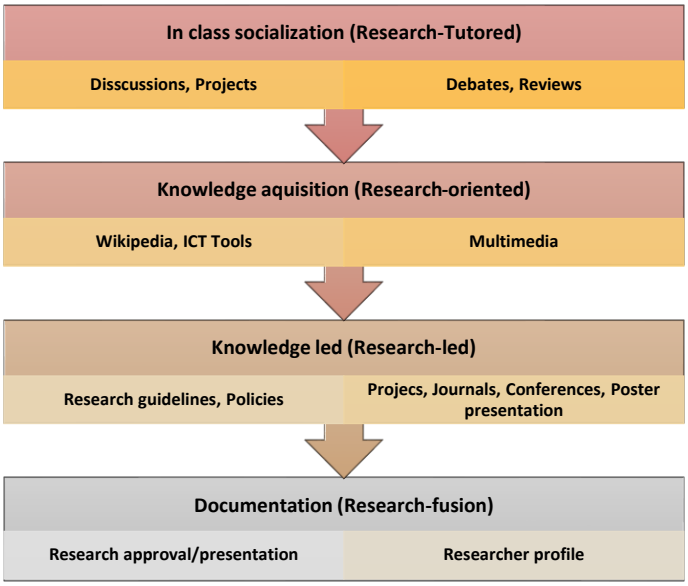

Figure 1: Research framework

4. Methodology

In this paper, we explore a) student involvement in different scholarly activities b) analyse research skill acquisition of the experimental group c) collect feedback to find students satisfaction level on FTBR approach.

A. Mixed Approach

The study aims to expand students research competencies through activities related to research. To achieve this goal, a mixed approach method (qualitative and quantitative) was used to analyse the data for broader understanding.

To measure and to get answer to the research questions quantitatively, set of questions were prepared and same questions were given to students in two phases:

- at the beginning of the semester (pre-analysis) to know their status on FTBR and
- at the end of the semester after acquiring research skills.

To measure the research questions qualitatively, interview questions were designed. Interview was taken with respective teachers of that class. Open ended questions were given more time. It also considered including questions to get an idea about teachers teaching who researchers are. Interview results provided major data to find answer to the research questions and are included in results section.

B. Experimental Approach

In this paper, experimental approach is used to analyse student experience before and after acquiring FTBR skills. The experimental research method is a practise to find solution scientifically and systematically [15]. This approach is one of the popular practises used to compare data before or after the experiment. Same treatment is given to both experiments (which is conducted before and after) and author determines the result after analysing the result of two experiments conducted in the beginning and at the end [16].

C. Participants

The participants of this study are graduate students enrolled for second semester in a private university in gulf consisting of boys and girls. To study participant's experiences about fusion teaching-research, a survey was conducted at the beginning of the semester and towards the end of the semester. There were about 30 students selected to participate in the experiment, studying in two sections of the same discipline. They were taught the same subject, followed same lesson plan and were taught by trained teachers active in research field. At the beginning of the semester a pre-survey was conducted to gather their feedback on their opinion to study their research experience. A post-survey was conducted to observe their achievement as part of FTBR experiment.

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D. Research Approach

In this paper, the main objective is to fuse research related activities into the teaching and learning process to have positive impact on enhancing students' interest towards learning. In view of this and to support this, various opportunities were provided for students and teachers to conduct research and a strategic approach was implemented to achieve this objective.

Figure 2given below depicts faculty engagement in FTBR framework:

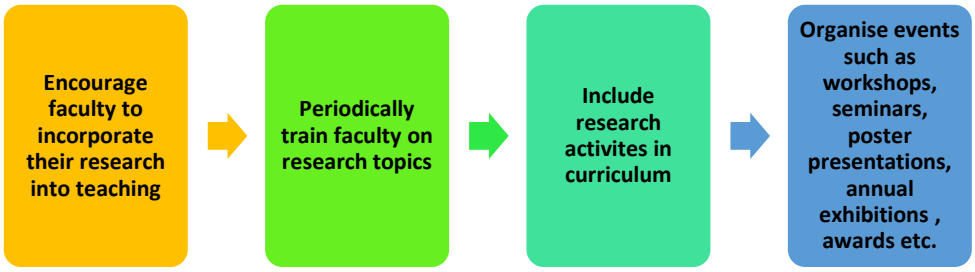

Figure 2: FTBR teaching framework for teachers.

Figure 3given below display events which are included in FTBR framework for students:

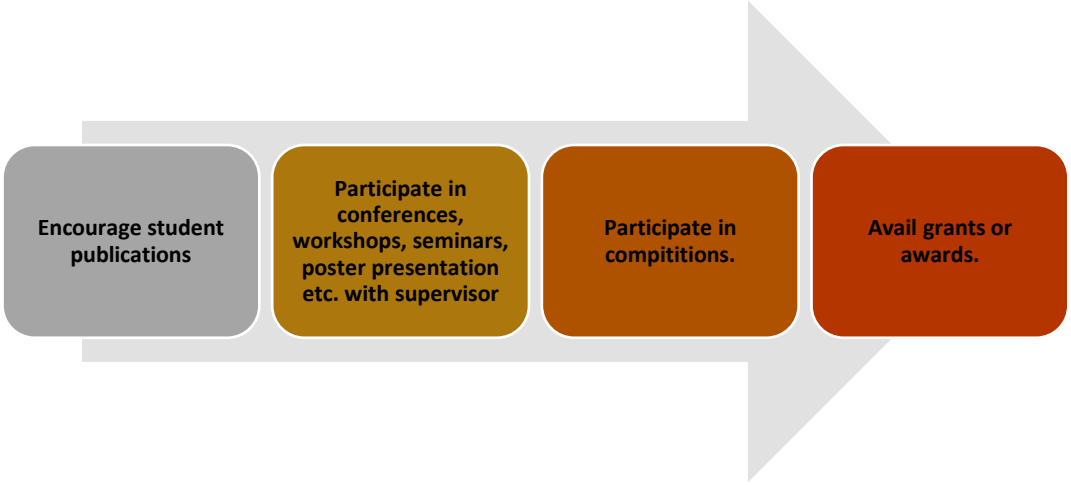

Figure 3: FTBR framework for students

Research-teaching has a connection between teaching and research. Fusion research is all about promoting learning through innovative methods. Learning is the most crucial objective of the education system and discussions have been carried out that it is 'learning' that connects research-teaching. Fusion research contribute to teaching, promoting, advancing, applying, synthesizing, and generating new knowledge. Fusion research is thus associated with generating research skills and exploring new knowledge. It is an area where the process of learning is given prominence and the role of the student in the process of learning, as an audience. Studies reveal the different forms of association of research-teachings which are:

- Research led: students gain knowledge based on staff research work.
- Research-oriented: students learn about the method of problem-finding and solving steps.
- Research tutored: groups are formed, and students discuss scholarly activities.
- Research informed: incorporating research disciplines, research pedagogy and norms to be followed.

Figure 4 given below is an example of student and teacher based FTBR research work model layout.

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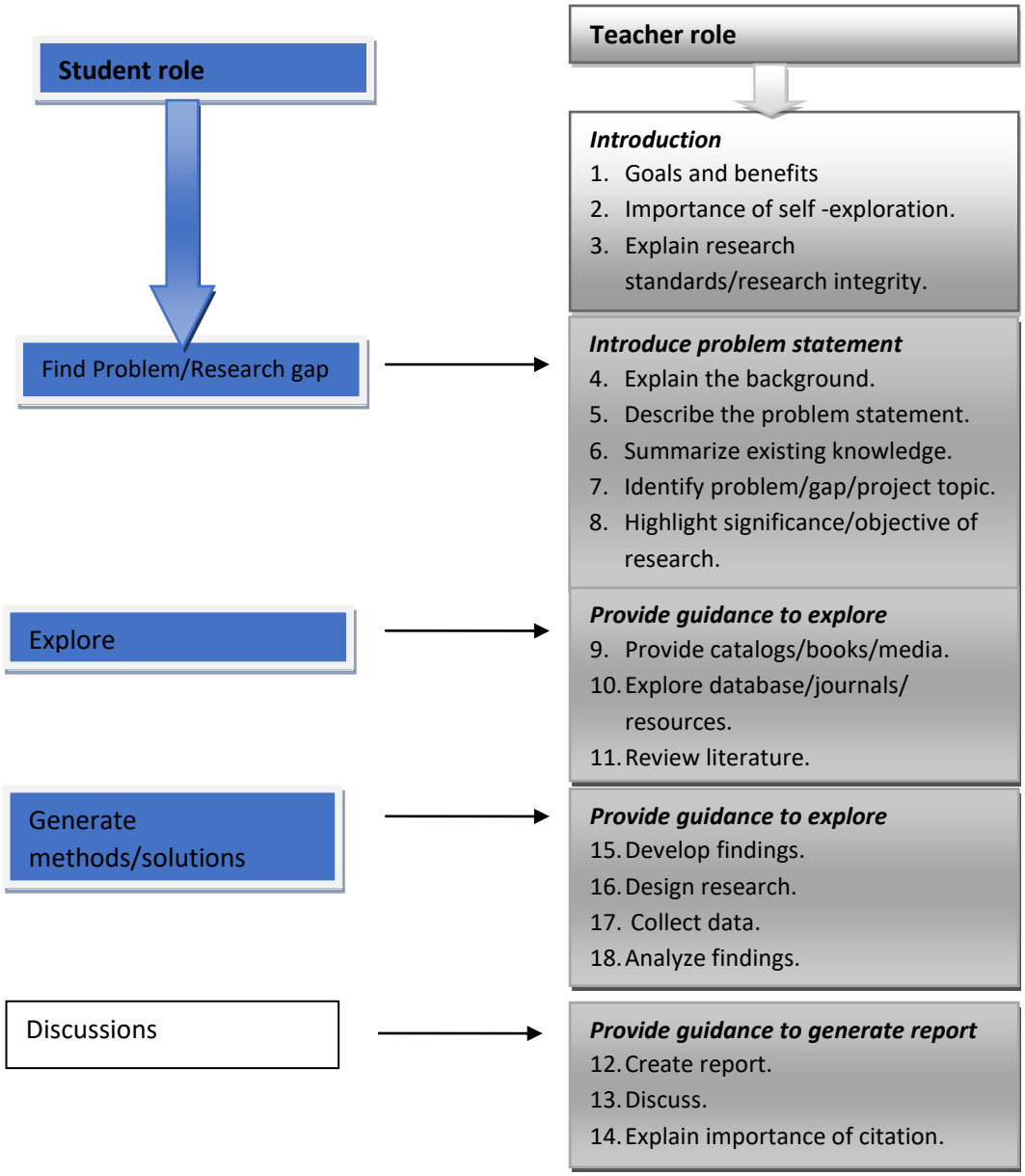

Figure 4: Example of student and teacher based FTBR research work model layout.

E. Questionnaires

Questionnaires are prepared and distributed using survey scan codes. Questions are explained and instructions were given to provide honest opinions. Questions were prepared to study:

- student involvement in different scholarly activities and
- student's satisfaction level for the specific research experiences during their research-based teaching and learning

F. Data Analysis

Data analysis is carried out by collecting the survey response data and analysed to estimate the levels of understandings of students' awareness and experience on teaching-research nexus. From the data collected, average mean is calculated based on the ratings shown in Table 1.

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Table 1: Scales of Ratings.

Rating	Mean
Very High	4.00
High	3.00 – 3.99
Moderate	2.00 – 2.99
Low	1.00 – 1.99

Students are assured that their identity will be kept confidential and not revealed. They are allowed to decline to participate or ask for excluding their responses at any stage of the survey. Students are advised to proceed with responding to the online form with the declaration that they have read the survey statements and explicitly provide their consent to the terms and conditions stated. In case of any queries, students were advised to contact the researchers.

The questions were designed to investigate six aspects of student perceptions of the fusion teaching–research:

1. delivery of student awareness on research activities by the teaching staff,
2. student perception of teaching and research staff priorities,
3. tangible effects of the teaching–research nexus on student learning,
4. tacit effects of the teaching–research nexus on student learning,
5. student perceptions of the global influence of the teaching–research nexus on the courses of study offered,
6. student opinion of the relative importance of the teaching ability, research profiles, scholarship, and industry experience of the teaching staff.

5. Results

In this paper, a systematic framework to fuse research activities into teaching to enhance student interest in learning through FTBR is described. The implementation of various approaches of implementing FTBR is mentioned in the methodology section. Students as well as teachers are encouraged in this process.

As far the results of learning using FTBR is concerned, teachers have followed the all the learning outcomes specified in the course objectives and expect maximum result though not 100%, but at the same time teachers admit that researching is a difficult field to incorporate into learning especially as it is not just writing texts but involves the whole big process of questioning, finding, exploring, finding solutions, following research integrity, generating reports etc.

In this regard, student attitude plays a very important role, and they were informed to be punctual, systematic, organized, and hardworking at their work to produce better results.

A. Student involvement in different scholarly activities

Students are made aware of research programs conducted at national and international level in the institution and encouraged for active participation under the guidance of faculty.

The results show the average mean score 3.09 which indicates that students' level of achievement on specific research activities as part of FTBR in the institution is high. Most of the student's involvement in workshops and seminars show very high with mean score 4.5 which shows fusion research keeps students engaged. Number of publications is with mean score 3.10, research assistance obtained has mean 3.05(the research work is supervised). Participation in scholarly events such as conference, exhibitions and seminars have mean score 2.45, 3.5 and 4.5 which shows active interest and involvement of students towards scholarly activities. Participation in poster presentation is with mean 3.15, research grants and awards are with mean 1.15 and 4 respectively. Participation at international level shows minimum score of 1.5. The average mean of pre-analysis (1.38) and post analysis (3.09) of the experimental group was found, compared and analysed which showed results of 81% of achievement in research skills acquisition through teaching using the FTBR framework. The overall result of pre-and post-analysis of the experimental group was found and percentage increase was calculated:

Percentage increase = difference between post and pre-analysis values / pre-analysis value x 100.

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In addition, students can achieve research skills at higher level if added support is given, involving them fully, which will result in publishing papers by a greater number of students in collaboration with their advisors or teachers.

Table 2: Standard mean of pre-and post-analysis of student research achievement.

Research activities	**Pre-Analysis**	**Post-Analysis**
Research articles published at international level	0	1.5
Publications	2.05	3.1
Work as research assistants	1.5	3.05
Conferences	1	2.45
Workshops	3.5	4.5
Seminars	2.65	4.5
Exhibitions	1.01	3.5
Poster presentation	2.1	3.15
Research grants	0	1.15
Research awards	0	4
Average Mean Score	**1.381**	**3.09**

B. Feedback and interview questions

Table 4 indicates feedback of student's satisfaction level for the specific research experiences during their research-based teaching and learning.

Table 4: Research feedback

Research Habits	**Mean Score**
Curriculum is FBRL based	3.77
Supervisor for the discipline is active in research	4
Research assistance obtained	3.59
Participation in scholarly work are supervised (journals /conferences/ data collection /data analysis)	3.15
Opportunities are provided for poster presentations, exhibitions, workshops and seminars	3.89
Student involvement in faculty research	2.03
Students are motivated by providing research grants/awards	3.55
Average Mean	**3.43**

Feedback result taken at the end of semester show high(mean=3.43) level of involvement of students in research activities. This is possible only because of strict FTBR implementation into the curriculum. The highest score (mean=4) for supervisor for the discipline is active in research, highlights that supervisors involvement in on-going research supplements the development of research skills among students. The next high score (mean=3.89) is shown for opportunities are provided for poster presentations, exhibitions, workshops, and seminars. Curriculum is FTBR based, research assistance obtained, has mean score3.77 and 3.59 respectively.

To promote research habits and to motivate students', awards and grants are provided for students involved in various research activities. This is done to motivate and develop their competent skills in research related activities. Students are motivated by providing research grants/awards has mean score 3.15 and participation in scholarly work are supervised (journals /conferences/ data collection /data analysis) [12] and student involvement in faculty research score 3.15 and 2.03 respectively.

Following analysis of the interview findings, reveal fusion of teaching and research which **is the main factor that identifies universities/colleges from other institutions**:

- all the participants preferred and pointed out that, "*It is impossible to conduct research if they are not guided by teacher/supervisor who is not active in research field*".

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- There was a strong agreement and belief among participants that, "*Research activities and teaching are interlinked/fused with each other*".
- "*FPRL transmits deep, advanced and latest knowledge and is extremely helpful in scenarios where the knowledge (in certain disciplines) is advancing so rapidly that books become obsolete*".
- "FPRL creates interest stimulates and develops students the quest to explore knowledge. This way learning takes place".
- "*FPRL is not just stipulated to individual level but provides global connection and learning*".
- "*The set of FPRL based assignments encourages to understand the functionality of research and gives valuable experience*".
- Students reveal that they have "*Little experience at reading scholarly works which is due to lack of interest or time*".

The feedback reveals that students' experiences on research aspects are quite limited due to the lack of interest or time for scholarly work [13].

C. Practical implications

The implications of this research can be applied at the university level. The findings discussed in the methodology and results section will expand research habits among students. The strategies will help the institution to attract institutional visibility and reputation.

6. Conclusions and Future Work

The study is conducted to promote research habits among students at graduate and undergraduate level. The results show the average mean score 3.09 which indicates that students' level of achievement on specific research activities as part of FTBR in the institution is high. Feedbacks collected demonstrate that the students' level of awareness are moderately high but their experiences on academic research need to be enhanced. Education systems role at enhancing and promoting research habits is crucial and focus is to be given to motivate to improve student experience through fusion practices on academic research development programs and giving more responsibility to students to do research works independently as well. It is also found that a proper curriculum plan that encourages and support students at developing student's skill to work collaboratively and independently will give more exposure to students to build their research skills. One of the objectives of this study is to support students with a curriculum that enhance the research culture among students. In this study, the academic development units have helped to create awareness and interest in research with the support of staff through various academic research-oriented programs and thus influencing students by implementing effective pedagogy to build students exploring skills inside and outside classrooms.

However, it is found that the FTBR at the graduate level is subjective to:

- nature of subject
- intellectual ability of the student

It is also found that this approach helps both teachers and students: collaborate, solve problems, boost the willingness to discover their findings, and work further to mutually benefit each other. Furthermore, it is found that FTBR has great impact on high performance students and to keep them engaged but for low performance students smaller research activities will support them to develop their skills. The study also highlights the importance of trained research teachers in implementing fusion based research in academics. Therefore, in this study, it is found that there exists a longstanding nexus or fusion between research and teaching/learning. There are several other factors that influence to enhance the relationship between teaching and research such as teaching styles which will be discussed in our future research work.

Funding: "This research received no external funding"

Conflicts of Interest: "The authors declare no conflict of interest."

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Received: January 28, 2023 Revised: April 27, 2023 Accepted: June 27, 2023