

INSTRUMENT TO INVESTIGATE VALUE FOCUSED THINKING IN
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Abstract

Now's a day project failure is a big threat in software industry. Developers are unable to complete the project with in the time and resources because they are unable to understand the "value focused" things and creating alternative in the project that why the projects lead to be failure. Value focused thinking is designed to focus the decision on the essential activities that must occur prior to solving the problem. In order to have a successful software development, the community needs to build the understand ability of value focused thinking which can be added in the software engineering education and Evaluating alternatives during the development. Due to guiding strategic thinking in the project, they decrease the failure rate of the project. To overcome these problems. There is a need to build the understand ability of student about the value focused thinking. These instrument helps to investigate the value focused thinking in software engineering education.

I. Background

Value-focused thinking (VFT) places values at the decision-making center. Explicit values make it easier to classify existing alternatives, generate new alternatives, communicate and negotiate, and identify new opportunities for pursuing decision making. A problem with a decision is when an incident happens and you have to choose how to respond; a decision opportunity is when you consciously decide to move away [1].

Value is everything the customer is willing to pay for and Waste is any activity that produces no value for the customer or user. The main objective of software engineering is to make and maintain prime quality software-intensive systems and services that provide value to their users and society as a full. Furthermore, software engineering activities have to add the maximum amount value as possible to support developers in completing their tasks given time, cost and resource constraints. as an example, developers may "value" tools that help them identify the simplest set of test cases, but may consider long planning meetings as a "waste" because they are doing not help them deliver a high-quality product [2].

As in Lean development, any activity that's not considered to feature value (to the customer but also developers) is also considered as waste and cause potential risks (e.g., frustrated customers and developers, project delays). However, explicit value and waste considerations must an out sized extent been neglected in software engineering within the past. specifically, while cost, safety, availability, and security have received some attention, broader human values (and the notion of import beyond business, economic and technical value) like compassion, social responsibility, and justice are a side concern in software engineering [2].

Additionally, since software and software development are pervasive (e.g., any product nowadays is supported or enabled through software and changes to societies and communities are often driven by innovations through software), value aspects in software and its engineering are getting even more essential. Therefore, value may be a much broader concept and may be checked out in terms of software package or service value, but is additionally related to the artifacts, process, practice and principle of software development

and also with the organization itself, its teams and even individual members. Also, as software engineers, we'd like to handle broader human and societal values additionally to what the software development community typically values (automation, productivity, quality, low cost) etc. [2].

Value-focused thinking could be a more creative method since it focuses on the various decision objectives and the way as many alternatives as possible is also generated from decision advantages, and the chief tries to explore unknown solutions to the matter. it's argued that this time of departure makes it easier to attain the required consequences of the choice. By using value-focused thinking, one starts with the simplest potential outcome so works really hard to realize it [4].

In the process of development of Value-Focused Software (VBS), a revolutionary concept is applied to achieve an economic leverage. The high uncertainty occurs in relation to the result after its introduction of an innovative idea. When designing these systems, the level of uncertainty is very high. The involvement of relevant stakeholders in the achievement of desired results is highly desirable in the Phase of production of those systems [5].

Processes of Value Focused Software Engineering (VBSE), have a significant impact on VBS software development efficiency. The value-Focused approach combines the value principles with the current and changing software engineering (SE) doctrines and all these doctrines support one another in the development of a new paradigm [6].

Barry Boehm and his mates describe VBSE as "the explicit concern with value concerns in the application of science and mathematics by which computer software properties are made useful to humans"[7]. In VBSE, realizing an innovative idea is the first and foremost question. There is no previous recognition by the industry of an innovative idea, and the calculation of feasibility is unlikely before the idea is implemented [8]. Researchers however define the word value in terms of economic or monetary value of something, with the passage of time "the scope of VBSE research expanded to include non-economic and monetary aspects of value"[7].

Value-focused thinking (VFT) is a humanistic discipline to guide decision makers.

It has three major ideas: start with values, use values to produce best alternatives, and use values to assess those alternatives.

- Start with values. Instead of starting with alternatives, start with the decision makers' and stakeholders' objectives.
- Produce best alternatives. Once you've known values, use them to produce better alternatives.
- Use values to evaluate alternatives. Finally, use the values to evaluate alternatives through the operations-research method called multiple verifiable decision analysis.

VFT is a team sport. The whole team of decision makers and analysts must get the humanities and actively cooperate to create higher-value alternatives for future customers. Keeney lists nine advantages of value-focused thinking. Even though most of these advantages are self-explanatory, there are three that can be useful in operational analysis. First, value-focused thinking provides direction for strategic thinking by capturing the intent of the mission by the commander. Second, value-focused thinking helps in assessing alternatives through the use of multiple objective decision analysis. Third, value-focused thinking helps in developing alternatives by assessing the value gap between the ideal state and the best alternative. [18].

II. Related work

There are numerous studies conducted on value Focused software engineering. It is found that Emily Winter et al. [9][10] Performed two study 's on human values in software engineering. In first study [9] they studied about Advancing the Study of Human Values in Software Engineering This paper argues for the study of human values in Software Engineering (SE) as a highly significant emerging research area with significant societal impact. To advance this research agenda, its offer two key principles: firstly, the significance of values as distinguished from, though linked to, ethics; and secondly, the need for clear theoretical frameworks for Values Study. Emerging findings from the initial study (N=12 participants) are presented using a Values Q-Sort tool designed in accordance with these two principles. In second study [10] Emily Winter and Maria Angela Ferrario Studied human values in software engineering. They discussed that there is a pressing need to understand how human values function, develop methods and tools to study them in a context of software

engineering, and expand on this understanding to consider how SE research could contribute to a more socially responsible software sector. Both studies[9][10] have focused on human values in software engineering. But the proposed work is different in sense that it is focused on value Focused thinking in software engineering education.

Similarly, a study on value Focused software engineering is conducted by Paul Ralph et al. [11] They defined aims and explain the different types of waste in the production of software. This study is empirical and contains the first taxonomy related to waste. This identifies nine wastes and addresses their causes, underlying tensions and overall relation to the taxonomy of waste found in Lean Software Development. But this study focused on Grounded theory does not accept the generalization of statistics. While the taxonomy suggested seems generally applicable, organizations with different software development cultures will experience different types of waste.

Barry Boehm et al conducted three studies on value Focused software engineering [12][13][6]. In first study [12] a way for making evolution toward Value-Focused Software Engineering is presented with its advantages on a national or global level [14]. In the spirit of concurrent software and system engineering, it focused on its initiatives, contributions, and outcomes at the combined software and information technology (SW/IT) level. In the spirit of parallel software and system engineering. The overall aim is to build and practice fundamental knowledge. In second study [13] they presented an initial Value-Focused Software Engineering (VBSE) theory "4+ 1." The engine at the core is the win - win Stakeholder Theory W, which asks "what values are important? "And" What is assured of success? "For the software engineering company in question. The four more theories it draws on are utility theory. In third study [6] they performed the value-Focused approach to software development that includes value considerations with existing and evolving concepts and procedures in software engineering, while establishing an overarching context in which these approaches compatibly complement one another.

Although all the above explained studies significantly reported the various works. One of the studies [13] proposed 4+1 theory for value

Focused software engineering while, other researcher [12] represent the overview and research agenda. The researcher in other paper [6] performed value Focused approach to software development. But, proposed work is different from these in the sense that it is focus-sing on value Focused thinking with education perspective in software engineering.

Likewise, Anne Am eels et al[15]. Reported about merit Focused management (VBM). Since VBM is claimed to be changing financial management at the highest level in some of the world's largest companies, this literature review compares the value-Focused management approaches of six consultants, viz. Stern Stewart & Co, Marakon Associates, McKinsey & Co, Price Water house Coopers, L.E.K. Consult-i. This paper mainly focus-sing on value Focused management control process that helps to create the value through integration. For this purpose, the author has conducted the research using simple literature review.

Although the existing studies have significance

reported the importance of value Focused thinking in software engineering. However, none of them focus on value Focused thinking integration with software engineering education. There are three research question.

RQ1: What is perceived awareness of value Focused

thinking in software engineering education?

RQ2: What practices make value base thinking in

software engineering education?

RQ3: How these practices can be diffused in software engineering education?

III. Research Methodology

A. Survey

A survey will be conducted by following the guideline of Kasunic [16] published by Software Engineering Institute (SEI). We followed his work as it is most commonly and widely used handbook for conducting effective survey in field of software engineering [16]. Figure 1 shows the steps for survey conduction from work of Kasunic[16].

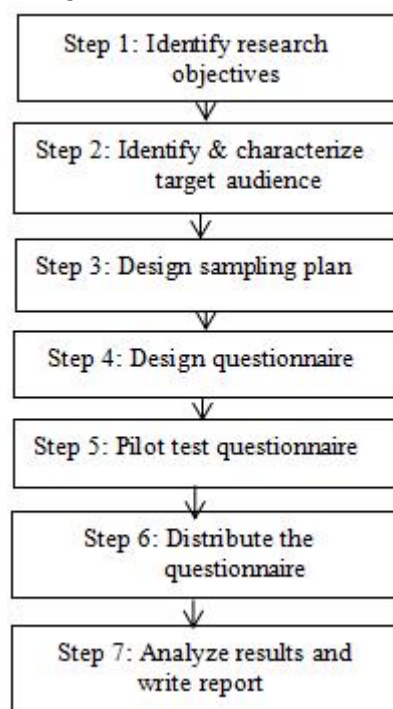


Figure 1: Steps for survey conduction, adopted

Step 1: Identify research objectives

There are three objectives of our research. The first objective of our research is "To identify awareness about value Focused thinking to student and faculty". The second objective of the study is "To identify the practices which make the value base thinking in software engineering

education". The third objective of the study is "To generate an approach for diffusing value Focused thinking in software engineering education".

Step 2: Identify & characterize target audience

After identifying objective of study declare the target audience which are included in the survey.

The target audience of this study is only faculty and students of the software engineering department of NUML, ISLAMIC, NUST, FAST, BAHRIA and COMSAT University.

Step 3: Design sampling plan

After identify and characterized target audience declare the sampling size of the target audience. The approximately sample size of including student for survey is from 4th semester to 8th semester. The approximately sample size of including faculty is all faculty of software engineering department of NUML, ISLAMIC, NUST, FAST, BAHRIA and COMSAT University.

Step 4: Design questionnaire

The questionnaire design according to the research questions and objectives. The

Survey Questionnaire

Section:2 Awareness

That is your level regarding value focused thinking awareness?

☐ Basic ☐ Intermediate ☐ Advance ☐ Expert

Table I: Questionnaire: Awareness [17]

Questions:	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
Do you think it is necessary to do an assessment to measure the awareness of value focused thinking in software engineering education?					
Would you think we can use value focused Thinking method in a university environment as a part of software engineering education?					
Would you think value focused thinking awareness is essential to reduce human error					
Do you think it is necessary for all student to be aware of value focused thinking during the study of software engineering education?					
Would you think awareness of value focused thinking is important for student before including in software engineering education?					

Section:3 Practices

(Guiding strategic thinking , Evaluating alternatives ,Creating alternatives)

Table II. Questionnaire: Value focused thinking Practices[18].

Questions:	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
1) Would you think Guiding strategic thinking is useful in software engineering education?					
2) Do you think Evaluating alternatives is useful in software engineering education?					
3) Do you think Creating alternatives is useful in software engineering education?					

questionnaire can be divided into three sections. The first section id awareness", second one is "Practices" and third one is "How to diffuse these practices".

Step 5: Pilot test questionnaire

In pilot testing to validate the questionnaire by applying six steps of validation.

1. Establish face validity
2. Pilot test
3. Clean data set
4. Principal component analysis
5. Cronbach's alpha
6. Revise questionnaire

The last two steps of survey is describe in future work.

IV. "Instrument for Investigating Value focused thinking in software engineering education"

4) Would you think Guiding strategic thinking , Evaluating alternatives and Creating alternatives necessary to include at university level education?

5) According to you which practice is more valuable?

☐ Guiding strategic thinking ☐ Evaluating alternatives ☐ Creating alternatives

6) According to you what practice is most useful to reduce waste material for you while you would be developing a system?

☐ Guiding strategic thinking ☐ Evaluating alternatives ☐ Creating alternatives

Section 4: How practices can be diffused

Table III. *Questionnaire: How practices can be diffused*

Questions:	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
7) Would you think including the value focused thinking practices as a part of undergraduate study in software engineering is a way to diffuse practices in software engineering education?					
8) Do you think make compulsory to apply value focused thinking practices in the class base project is way to diffuse the practices in software engineering education?					
9) Do you think conduct workshops about benefits of applying value focused thinking practices in the project is way to diffuse the practices in software engineering education?					
10) Do you think make compulsory to apply value focused thinking practices in the final year project is way to diffuse the practices in software engineering education?					

11) What action can take to diffuse value focused thinking practices in software engineering education?

☐ Make part of study ☐ Apply in every class project ☐ Conduct workshop ☐ Apply in final project

V. Results and Data Analysis

A. Demographic Profile of Respondents

The final survey was administered to 50 faculty members and 200 students from six universities

Table IV. *Faculty Demographic Profile (N=50)*

Attribute	Category	n	%
Institute	NUML	12	24%
Institute	IIUI	12	24%
Institute	IQRA	7	14%
Institute	Bahria	5	10%
Institute	GCUF	5	10%
Institute	NUST	3	6%
Institute	FAST	3	6%
Institute	Ripah	3	6%
Qualification	PhD	38	76%

offering software engineering programs in Pakistan (NUML, Bahria University, GC University Faisalabad, International Islamic University Islamabad, NUST, FAST-NUCES, IQRA University, COMSATS, Mirpur University of Science and Technology, Abasyn University and Capital University). Table IV and Table V summarize the demographic profile of the two respondent groups.

Qualification	M.Phil	12	24%
Gender	Male	40	80%
Gender	Female	10	20%

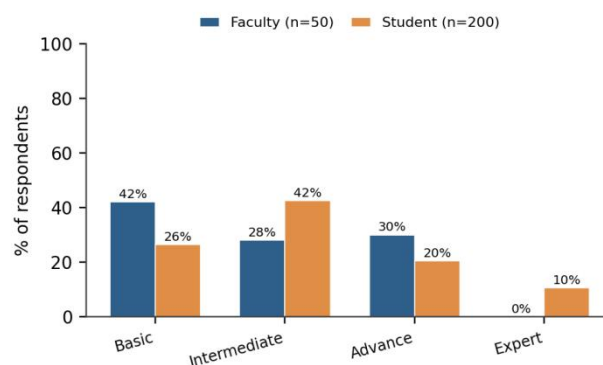
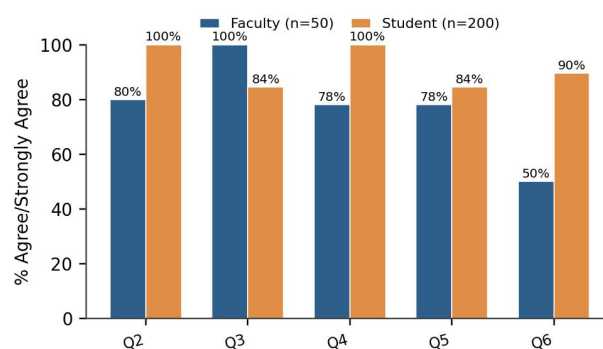
Table V. *Student Demographic Profile (N=200)*

Attribute	Category	n	%
Institute	NUML	63	31.5%
Institute	Bahria	27	13.5%
Institute	IIUI	27	13.5%
Institute	GCUF	19	9.5%
Institute	NUST	18	9%
Institute	FAST	14	7%
Institute	Mirpur UST	9	4.5%
Institute	Comwave	7	3.5%
Institute	COMSATS	6	3%
Institute	IQRA	5	2.5%
Institute	Abasyn	4	2%
Institute	Capital	1	0.5%
Semester	4th-8th (mixed)	200	100%
Gender	Male	146	73%
Gender	Female	54	27%

B. Awareness of Value-Focused Thinking (RQ1)

Fig. 2 shows the self-reported awareness level of VFT (Q1). Only 30% of faculty and 10.5% of students rated themselves "Advance/Expert," while the majority of both groups sit at "Basic/Intermediate" level, confirming a genuine awareness gap that motivates RQ1. Fig. 3 reports the percentage of respondents who

Agreed/Strongly Agreed with statements Q2-Q6 on the importance and necessity of VFT awareness. Agreement is uniformly high for both groups ($\geq 80\%$ for faculty, $\geq 86\%$ for students on most items), indicating that although current awareness is low, both faculty and students strongly endorse building VFT awareness into software engineering education.

**Fig. 2.** *Self-reported awareness level of VFT (Q1).*

*Fig. 3. Agreement with awareness statements Q2–Q6 (% SA+A).***C. Practices of Value-Focused Thinking (RQ2)**

Fig. 4 shows agreement on the usefulness of the three VFT practices – guiding strategic thinking, evaluating alternatives and creating alternatives (Q7–Q10). Both groups agree strongly ($\geq 70\%$) that all three practices are useful, with students showing marginally higher agreement than faculty on Q7 and Q10. Fig. 5 compares which

single practice each group values most (average of Q11 and Q12). Students favor “Guiding strategic thinking” most (44%), whereas faculty are evenly split between “Guiding strategic thinking” and “Evaluating alternatives” (35% each), suggesting faculty place relatively more weight on evaluation-based practice than students do.

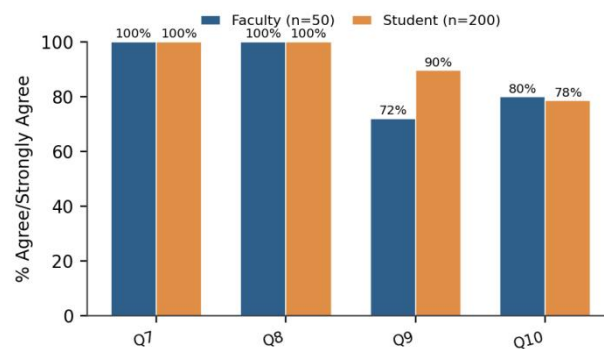
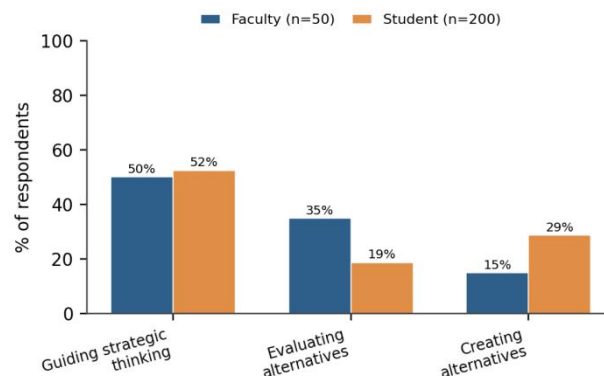
*Fig. 4. Usefulness of VFT practices – % agreement (Q7–Q10).**Fig. 5. Most valuable VFT practice, average of Q11 and Q12.***D. Diffusion of Value-Focused Thinking Practices (RQ3)**

Fig. 6 presents agreement with four candidate diffusion strategies (Q13–Q16). Both groups again show high agreement (mostly 70–95%), with students slightly more supportive of workshop-based diffusion (Q15, 100%) than faculty (72%). Fig. 7 shows which single diffusion action each group actually prefers (Q17). Faculty

most prefer “making VFT part of the study” (52%) and “applying it in the final project” (28%), while students are more evenly spread, with “conducting workshops” as their top choice (31%) followed closely by “making it part of the study” (26.5%). This divergence suggests curriculum-embedding is the faculty-preferred route, while students respond better to hands-on workshop exposure.

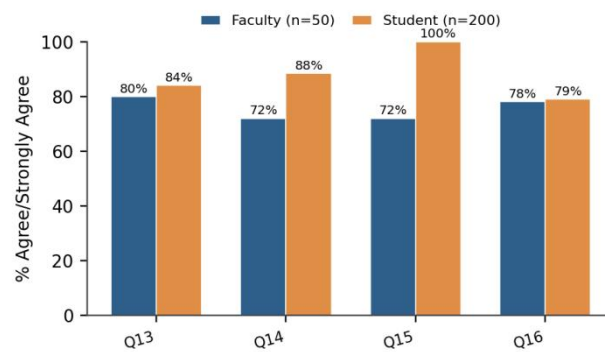


Fig. 6. Agreement with diffusion strategies – % agreement (Q13–Q16).

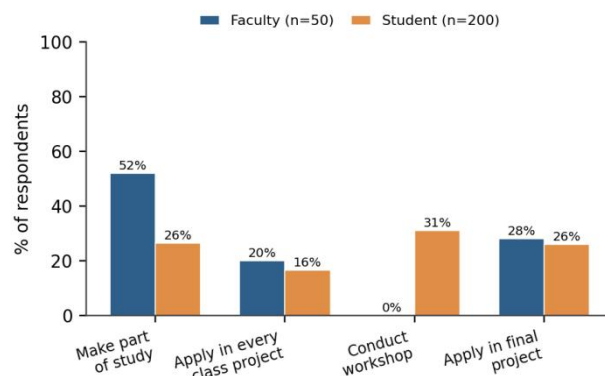


Fig. 7. Preferred action to diffuse VFT practices (Q17).

E. Discussion

Across all three research questions, faculty and student responses converge on the core message: awareness of VFT is currently low, but both stakeholder groups strongly value the underlying practices and support its integration into the curriculum. The main divergence is not whether to diffuse VFT but how: faculty lean toward formal curriculum embedding (coursework, final-year projects), while students respond more positively to experiential formats such as workshops. This complementary picture suggests that an effective diffusion strategy should combine both routes – embedding VFT concepts in course content while also offering hands-on workshops – rather than relying on a single mechanism. The questionnaire itself was validated using Kasunic's six-step pilot process (face validity, pilot testing, data cleaning, principal component analysis, Cronbach's alpha and revision), supporting the reliability of the instrument used to collect this data.

VI. Limitations

The scope of this research will be limited to the following. This research will focus on value Focused thinking in software engineering education. The target audience for this study is

only faculty and students of the software engineering department. This research will target the audience of NUML, ISLAMIC, NUST, FAST, BAHRIA and COMSAT University. The approximate number of samples for student is including student from 4th semester to 8th semester. The approximate number of sample for faculty is including all faculty of software engineering department.

VII. Future Work

This study currently reports awareness, practice-preference and diffusion data from six universities in the Islamabad/Rawalpindi region. Future work will extend the survey to a larger, more geographically diverse sample across Pakistan, apply inferential statistics (e.g., chi-square tests) to formally test faculty-student differences, and develop and pilot a VFT training module for software engineering courses based on the diffusion preferences identified in this study.

VIII. Conclusion

This study makes three contributions to software engineering education. First, it reports the perceived awareness level of value-focused thinking (VFT) among 50 faculty members and 200 students across six universities, showing that

current awareness is low even though both groups strongly value VFT practices. Second, it identifies which VFT practices (guiding strategic thinking, evaluating alternatives, creating alternatives) each stakeholder group considers most useful, revealing a modest but meaningful difference in emphasis between faculty and students. Third, it proposes and empirically compares approaches for diffusing VFT practices into software engineering education, showing that faculty favor curriculum embedding while students favor workshop-based exposure. Together these findings provide an empirically grounded contribution to the software engineering body of knowledge (SEBOK) and a practical starting point for diffusing value-focused thinking into software engineering curricula.

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