Analysis of

Design of Feedback Forms in Virtual Labs

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Design of Feedback Forms for Virtual Labs

Feedback is fundamental in ensuring that Virtual Labs is available, effective to the students/stakeholders, and delivers good 'user experience'. This document is to validate that the feedback forms and collect information that will help in meeting the objectives set forth for the Virtual Labs. A set of qualities that the feedback form must have has been discussed. The feedback forms currently being used by Virtual Labs and the proposed forms,have been assessed with respect to these qualities.

Objectives of Virtual Labs

Some of the objectives stated in the DPR, that are relevant to the capturing of feedback from the students /other stakeholders , are:
.
(a) To maintain/upkeep the existing operational Virtual Labs.
> Over 100 Virtual Labs have already been developed and many of them are being widely used by various colleges. It is important to keep these labs in 'up and running' condition. Usage pattern of these labs show that these labs are increasingly used 'outside' the working hours, which was one of the original motivations for this project. .. _Based on the user-feedback, bugs will be identified and fixed._

(b) To port Virtual Labs to a common platform and host it on a national server.
> Significant engineering effort is therefore needed to propel the Virtual Labs to the next level where
> > *(a) they run from a common web framework and runtime environment,*
> > *b) all the labs are hosted on a common national server*
> > *(c) they provide the user with a rich virtual lab environment .. required to integrate the use of Virtual Labs with the academic and learning process at the colleges.*

(c) To create a 'single package' of simulation-based Virtual Labs to for distribution.
> Whereas objective (b) ensures that the labs be hosted on a national server, given the limits of connectivity in some remote/backward areas of the country, a number of colleges may still face _difficulty in accessing and using these_.

 (d) To engage private agencies for outreach of Virtual Labs to create awareness about labs and usage of labs.

(e) To identify the gap areas between the typical syllabi of technical universities and the existing labs and to develop additional labs/experiments to fill these gaps.
> Given the different syllabi across the country, these still do not _address all aspects of a typical Undergraduate Engineering syllabus._

(f) To convert labs not based on free and open source technologies to open source.

(g) To port the existing labs to Mobile platforms.

(h) To identify and work with government, private agencies and professional bodies for granting 'Certificate to users of Virtual Labs'.

> *Although Virtual labs aim to underline supplement the academic requirements of the UG students, much needs to be done so that the students can be evaluated after they attempt the experiments. [Section 2, page 10 and 11 of the DPR]*

Virtual Labs feedback form must align with these objectives and provide details about the usage experience of the students that will help in validating the achievement of the above listed objectives. Though the above section covers all the objectives stated in the DPR, only objectives that are influenced by the students usage of the labs have been considered. Other objectives have been stated for the completeness of the document.

What must Feedback Forms do ?

Feedback forms must answer the following questions:

1. Is the feedback form assessing the objectives of the experiments, and the learning extent of the students?
2. Is the feedback form easy to understand and respond clearly and objectively ?
3. Are the responses amenable to analytics ?

Keeping these as the basis, the qualities relevant to the scenario must be covered in the feedback forms. This document focuses on points 1 and 2 . Point 3 has not been not discussed.

Qualities of an effective Feedback Form

Like any artifact, feedback forms must also meet specific requirements which are both functional and nonfunctional. Since feedback is an instrument that is used in many situations and is part of almost every product or service, the qualities that it must exhibit are also fairly well established. Based on the literature study done, some of the important qualities that a feedback must assess for the product or service for which the feedback is being taken. These are the aspects that should be taken into consideration while designing the form. [Preston and Colman 2000] [Warren Smith 2013]

1. Objective Alignment – Extent to which the labs meet the relevant program objectives.
2. Curriculum Alignment – Does the content align with the curriculum prescribed for the students ?
3. Maintainability of application – Is the application easy to maintain ?
4. Availability – Is the experiment available ?
5. Accessibility – How easy it is to access the labs ?
6. Repeatability - Does repeated use of the lab give same outcomes ?

7. Other qualities that feedback should address are: Test-retest reliability, Internal consistency, Validity, Item-whole correlations, Ease, Quickness, Expressiveness, Inter-tertile Discriminating Power.
8. Benefit Assessment
9. Extent of Motivation induced by doing the experiment
10. Ease of Use – of the feedback form
11. Learnability

Every feedback must be measured on a scale or as a 'yes'/'no' attribute. Scaling attributes must be suggested in the responses to relevant feedback questions. This must be kept in mind when designing feedback forms.The scale chosen is also an important aspect and this is guided by research [Preston and Colman 2000][Warren Smith 2013]. Practitioners and Researchers have argued in favour of smaller scales like 0-5 or 0-4, arguing for the ease of cognition. [Fluidsurveys Team 2014]. Apart from scales enabling the intensity of User experience, scales have a strong influence on the ability of the users to exert their 'discriminating power' [Ferrando 2012] [FluidSurveys 2014]

Analysis of the current Feedback Form

The Outreach workshops gather feedback at the end of every workshop from every participant. Filling this feedback form is mandatory . A hard copy of the feedback form is filled in by each participant based on his 'experiment doing experience'.

Discussion

The form that is currently being used during outreach, is focused on two principle aspects. The first part focuses on verifying whether each of the experiments tried out by the participant is working or not and if it is not, the reasons according to participant . The second part of the form consists of four questions, that are inputs to a SWOT analysis- what is good about the labs, what are the problems, where else can this be used etc. User responses to these questions do not seem to give clear feedback on the achievement of the objectives of the Virtual Labs.

The form has to be filled manually,as a hard copy. The effort involved in filling it is large since every individual lab and experiment name along with the reasons as detailed above have to filled up. Typically every participant browses 10-20 experiments during the workshop. This has been creating a lot of resistance in the participant making the reliability of the inputs sketchy. Also this does not seem to be an user friendly model.

Also, other aspects or qualities that a feedback form should have (as listed in the earlier section of this paper,) have been inadequately addressed in these forms.

Having said all these, the current paper form gives the participant opportunity to say whatever is relevant.

The new forms that have been designed and proposed, are comparatively better and cover a larger part of the qualities enumerated in the earlier section.

Analysis of the proposed Feedback Forms

Keeping the study and discussion points in mind three feedback forms were developed : generic level, lab level and experiment level. The following is the comparison done to ensure that the redesigned form is compliant to the requirements

Discussion

Table 1 shows the comparative alignment of the current feedback form and the proposed form. These are in relation to the 'User perceptions' of the quality attributes. The table compares the alignment in terms of attributes and is divided into 3 sets – Specific Objectives, Other Qualities and Common Objectives.

'**Specific Objectives**' are those aspects of the Virtual lab that must specifically be assessed in the feedback. Objective alignment looks for the extent to which the Virtual Labs objectives are assessable by the user feedback. There are aspects of the objectives such as – objective (f) - to convert labs to open source technologies etc. which are not applicable to the scope of the feedback being discussed here.

Table 1: Comparative alignment - qualities required in feedback forms			
Current Form & Proposed - Experiment, Lab & Generic level forms			
	Factors/ Qualities to be assessed by the Feedback form	Are the stated factors covered by the form ?	
		Current Form	Proposed Form
Specific Objectives			
1	Validation of doing the experiment	No	Yes
2	Objective Alignment	Yes (1/3)	Yes (3/3)
3	Curriculum Alignment	No	Yes
4	Maintainability of application	No	No
5	Availability	Yes	Yes
6	Accessibility	Yes	Yes
7	Repeatability	No	No
Other Qualities- .			
8	Inter tertile Discriminating Power	No	Yes
9	Test-retest reliability,	No	No
10	Internal consistency	No	Yes
11	Validity	NA	NA
12	Item-whole correlations	No	Yes
13	Ease – (of use of the feedback interface)	No	Yes
14	Quickness	No	Yes
15	Expressiveness	Yes	Yes

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Common Objectives			
16	Benefit Assessment	No	Yes
17	Extent of Motivation	No	Yes
18	Ease of Use – (of the labs)	No	Yes
19	Learnability	No	Yes
20	Quality of the labs	Yes	Yes
	Total # of Aspects	20	20
	# of Yes	5	15
	# of No's	14	3
	# of NA (Not Applicable)	1	1

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Objective alignment (S.No 2) has been explored in detail (hyperlinked) in the table. It can be inferred that that the current form addresses only 1 of the 3 relevant objectives and the proposed one addresses all 3.

'**Other Qualities**' set assesses the User perception of the form and the ease to fill in their experience. The various qualities that are mentioned in Table 1 are defined in the Glossary given at the end of this document.

The third set of qualities -'**Common Objectives**', assesses the common aspects of the Virtual Labs experiments being performed. These include quality,ease of use,motivation to reuse them and benefits . These help measure the overall impact of the labs on the students using Virtual Labs.

The comparison tabulated below(Table 2) is done to ensure that the proposed feedback form actually covers most of the important qualities that it must address. The table shows the list of qualities addressed by each of the forms.

Table 2: Overall alignment of feedback forms

Quality sets in Feedback form design	Current Form	Proposed Form
Specific Objectives (# of Yes / # Aspects)	3/7 (42%)	5/7 (71%)
Other Qualities	1/8 (12%)	6/8 (75%)
Common Objectives	1/5 (20%)	5/5 (100%)
Overall Score	5/20 (25%)	16/20 (80%)

Note: Numbers in Table are extracted from Table 1 in earlier page of this document

Thus, an overall alignment of the form to the required qualities is 25% for the current form and 80% for the proposed forms.

Conclusion

The qualities that a feedback form must have been defined based on literature. These qualities have been used to redesign the current feedback form (used in various Outreach workshops) and propose a new one to make the responses more meaningful. The analysis and discussion has been presented in this document. The outcome of the assessment is that the proposed form is 80% compliant to the qualities that are desired, while the current one shows a 25% compliance. This validates the appropriateness of all the 3 proposed feedback forms – at the experiment level, at the lab level and at the generic level..

Glossary

"**Validity**- in assessment refers to the degree to which the results (scores) represent the knowledge or ability intended to be measured.

".. **Reliability** - measures refer to the consistency of the measurement over time and/or by multiple evaluators." [Cornachione Jr 2005]

"**Discriminating power** is the ability to distinguish between 2 groups being measured."
 [Psychology Dictionary]

"**item total correlation** is a correlation between the question score ..and the overall assessment score. [Greg Pope 2009]

  "**Internal consistency** is an assessment of how reliably survey or test items that are designed to measure the same construct actually do so. A construct is an underlying theme, characteristic, or skill such as reading comprehension or customer satisfaction. A high degree of internal consistency indicates that items meant to assess the same construct yield similar scores. There are a variety of internal consistency measures. Usually, they involve determining how highly these items are correlated and how well they predict each other. Cronbach's alpha is one commonly used measure." [Extracted quote]

References

1. Carolyn C. Preston & Andrew M. Colman: Optimal number of response categories in rating scales: reliability, validity, discriminating power, and respondent   preferences, Acta Psychologica 104,1 (2000) 1-15
2. Warren D. Smith, " Rating Scale Research relevant to score voting", June 2013 - (Extracted from the above article: "10-level scale seems, overall, the best / most popular") Best reference for 1-10 rating scales. Research article http://www.rangevoting.org/RateScaleResearch.html#conclusions
3. Pere J. Ferrando, "Assessing the discriminating power of item and test scores in the linear factor-analysis model", Psicologica (2012), 33, 111-134.
4. "Presenting Your Rating Scales -Numbered versus Worded Lists", FluidSurveys Team on February 26, 2014 in Reporting, Response Analysis, Best Practices, Collecting Data, Survey Design, How-To Article ("http://fluidsurveys.com/survey-design/)
5. Greg Pope, 'Psychometrics 101: Item Total Correlation', Blogpost on 'Questionmark' March 26, 2009 (https://blog.questionmark.com/168   )
6. What is DISCRIMINATING POWER? definition of DISCRIMINATING POWER (Psychology Dictionary)

7. Edgard B. Cornachione Jr, 'Objective tests and their discriminating power in business courses: a case study ', BAR - Brazilian Administration Review, On-line version ISSN 1807-7692, BAR, Braz. Adm. Rev. vol.2 no.2 Curitiba July/Dec. 2005

8. Extracted from page on http://support.minitab.com/en-us/minitab/17/topic-library/modeling-statistics/multivariate/item-and-cluster-analyses/what-is-internal-consistency/

Annexure 1 - Generic Feedback Form

View the HTML Version of the form on the feedback portal

Annexure 2 - Lab Feedback Form

View the HTML Version of the form on the feedback portal

Annexure 3 - Experiment Feedback Form

View the HTML Version of the form on the feedback portal