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Eliciting User Feedback During System Development

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ABSTRACT

Eliciting user feedback is an integral part of developing management information systems. A field experiment was conducted to study the process of eliciting user feedback during the design of a new financial system. Two variables were investigated--presentation of a system document in "finished" versus "draft" appearance, and use of a structured (questionnaire) versus unstructured mode for obtaining response. Results show that (1) use of a questionnaire elicited feedback faster and with significantly higher quantity and total perceived quality, (2) there was no significant difference in quantity, perceived quality, or time to respond between draft and finished presentations, and (3) there was no statistical interaction between the study variables.

INTRODUCTION

User involvement is critical to the development of successful management information systems (DeBrabander & Edstrom, 1977). Further, the relationship between users and developers is most beneficial when it is one of cooperation and mutual understanding (Duncan, 1974). Acknowledging these findings, modern practices and methodologies for systems analysis, design, and installation aim for consistent user/analyst interaction (via interviews, meetings, work groups, review sessions, inspections, etc.). Consequently, a series of user/analyst feedback loops is created, generating the information needed to build systems (King & Cleland, 1971). While such practices are fast gaining in popularity, little empirical research has been done to study the mechanics of these feedback processes in an information system environment (Ramsey & Atwood, 1979).

Although the specific topic of eliciting user feedback is not comprehensively addressed by any one body of information

systems literature, reference to various aspects of the subject are found interspersed throughout. A survey of this existing literature reveals that eliciting user feedback (1) has several purposes of key importance in determining system content and form, and (2) is prevalent in all phases and most methodologies of modern system development.

Purpose of Eliciting User Feedback

With regard to the purposes of user feedback, several specific objectives for obtaining user feedback can be identified in the literature.

1. Detection of Errors. IBM researchers have conducted extensive tests on program walk-throughs and inspections and have concluded that errors can be efficiently and effectively detected by obtaining feedback from other analysts and programmers (Duncan, 1974). They also suggest that if similar feedback loops are set up

involving users and analysts, errors introduced during the information requirements and design stages (i.e., contradictions, omissions, or wrong information that would require the resulting system to be corrected) could be detected early and at less cost.

2. Determine Improvements. Just as the user can be important in detecting errors, the user is invaluable in working with the analyst to improve the design, implementation, and operation of a system. Improvements include changes to the system that would result in a more useful, cost effective system. Bolan (1978) performed an experiment to compare the traditional analyst dominant protocol for user/analyst interaction against a protocol where analysts and users shared responsibility for teaching, suggesting, and critiquing systems work. Ideas resulting from this alternative protocol were of significantly higher quality, as judged by a panel of experts.
3. Determine User Attitudes. User feedback can help pinpoint "human" problems that may occur during development and installation. Thus, one of the main tasks of developers should be to anticipate and track user reactions, attitudes, and behaviors. Based on empirical work using the Schultz-Slevin questionnaire to obtain user feedback, King and Rodriguez report that user attitudes and value perceptions can and should be identified and changes detected over the life of the system development effort (King & Rodriguez, 1978).
4. User Education and Involvement. Eliciting feedback increases the

interaction between users and analysts, and facilitates the education and training of the system users early in the development process. The implementation literature consistently proclaims the importance of user involvement in designing systems (DeBrabander & Edstrom, 1977), and several empirical studies have been conducted to determine the factors contributing to systems project success. These studies concur that user involvement is significantly related to positive user perceptions about the resulting systems (Evan & Black, 1967; McKinsey & Co., 1968; Smith, Brown, Culhan, Amspoker, 1973; Swanson, 1974).

Prevalence of Eliciting User Feedback

Reference to user input and feedback is found increasingly in most areas of information systems. Recent MIRA and design methodologies propose multiple step processes with user/manager interaction interspersed. MIRA approaches such as decision analysis, data analysis, critical success factors, syntactical analysis, and semantic analyses make liberal use of interviews, feedback sessions, and user reviews. Design methods such as structured analysis and design, entity relationship diagrams, PSL/PSA, etc., also assume significant user/analyst interaction to obtain information and review resulting documents. These MIRA and design methods primarily address the kind of information the analyst should look for, the procedures applied to this information once it is obtained, and in some cases, techniques for documenting the results. However, other than generally recommending processes such as surveys, interviews, observation, or group processes, few guidelines are given as to how the analyst should go about getting the information (Ramsey & Atwood, 1979).

Yet, it is agreed that one of the main advantages of these methodologies is the frequent inspection and feedback loops.

Study Variables

This research reports on a field experiment focusing on two aspects fundamental to eliciting user feedback by mail during system design. First, what are the differences in feedback elicited via a structured versus unstructured mode for response? Traditionally, users receive a system document for review and are free to respond in any way they wish (unstructured mode). Would the feedback process be facilitated if analysts provided users with a structured mode for response (i.e., a questionnaire) instead? Or would such a structure constrain the user resulting in loss of important feedback? Second, are there differences in feedback obtained from documents presented in finished versus draft appearance? Traditionally, analysts try to present users with a clean, finished appearing system document, rather than one appearing to be in draft status. Analysts must make decisions daily as to when a document is ready for review. Often, analysts spend hours and even days converting already legible diagrams, tables, charts, etc., into perfect type copies, only to drastically change them after user review. Additional versions are costly and time-consuming and it would be extremely useful to know if there is any payoff.

HYPOTHESES

Hypotheses were formulated about these two study variables--structured versus unstructured response mode and draft versus finished appearance.. These hypotheses are stated below and expected results are proposed based on existing literature as well as on common professional practices.

The quantity of feedback (number of suggestions, corrections, and comments) generated when a system document is presented for review with a structured mode for response (questionnaire) is significantly higher than that generated by an unstructured mode for response.

The perceived quality of feedback generated when a system document is presented for review with a structured mode for response (questionnaire) is significantly higher than that generated by an unstructured mode for response.

The response time (time elapsed between requesting feedback and receiving feedback) for a system document presented for review with a structured mode for response (a questionnaire) is significantly less than when an unstructured mode is used.

The usual procedure for soliciting input from users by mail involves sending them the document with a cover letter explaining the need for review and asking for comments or suggestions to be returned in writing. The track record for obtaining meaningful feedback via such methods has been extremely poor. Analysts agree that busy users expend little effort on reviews, scanning a document to provide a few obvious comments so that the task can be removed from their "to do" list. The alternative idea of using a structure (operationalized via a questionnaire) to elicit feedback by mail during system development has not been treated extensively in the literature. Questionnaires have been occasionally proposed as part of a larger methodology in MIRA studies (Henderson & West, 1979) where an analyst has been directly involved. However, no guidelines were suggested as to how to construct the questionnaire and the resulting feedback has not been subjected to any empirical test. The Delphi technique has also made use of a series of questionnaires interspersed with feedback, to provide systematic solicitation and refinement of

anonymous group opinion on complex, ill-structured problems. This has been empirically tested against the conventional discussion group and found superior (Swanson, 1974). Questionnaires have also been used in system evaluation (Pearson, 1977). These use closed questions (ratings, semantic differentials, etc.) which can be quantified and an overall measure of "user satisfaction" obtained. Open ended questions to detect errors and system improvements have not been attempted.

In the marketing discipline, however, the questionnaire is a well established tool to aid new product development (Ferber, 1974; Green & Tull, 1978). This approach may be directly applicable to information systems since the user is, in fact, a prospective "customer" and the system under design can be viewed as the "new product." Thus, the questionnaire developed for this study can take advantage of the proven methodology already established in the marketing discipline. This alternative approach, adapted from marketing research, suggests that providing a structured mode for response (typically a questionnaire) could force the users' attention to focus on all the major aspects of the document. Thus, they should catch more problems, or generate more and better ideas for improvement. Also, providing a questionnaire structures the task so that the user knows exactly what is required and can proceed step by step with a definite end in sight. This may result in users being motivated to respond more quickly.

The perceived quality of feedback generated when a systems document is presented with a finished appearance for user review is significantly higher than that generated when a draft appearance is used.

The quantity of feedback generated when a system document is presented with a finished appearance for user review is significantly higher than that generated when a draft appearance is used.

The response time (time elapsed between requesting feedback and receiving feedback) for a system document presented with a finished appearance for user review is significantly less than when a draft appearance is used.

No research in the specific area of information systems has been done to determine if it is really necessary to provide users with a final appearing system document for review, or if the document before final "polishing" will suffice or even obtain better feedback. Most practitioners feel strongly that a draft appearance is detrimental (Shoor, 1978). Previous research in psychology and human information processing provides some background. The Fritz Heider model (Heider, 1958) defines two factors contributing to individual performance--ability and motivation. If a user is more able to review a document, performance in giving feedback should be better. Studies in human information processing/marketing support this, showing that information presented to consumers tends to be used only if it is easy to process (Russo, Krieser, Miyashita, 1975). Also, since performance is related to motivation, a user motivated to review the document should provide better feedback. Again, human information processing research indicates that motivation is affected by perceived difficulty of the task. If an individual perceives a task to be very difficult, performance is low (Kukla, 1979; Van de Ven & Delbecq, 1974). User review of system documents is generally perceived as difficult. In addition, a draft appearance is usually thought of as more difficult to read, or process. These factors may add to the actual or perceived amount of human processing required to complete the task, lessening user performance, and therefore the quantity and quality of feedback. A document with a finished appearance is visually clearer and easier to follow and should facilitate the review process. The user may be more motivated to detect

errors, make constructive criticisms, and provide prompt feedback.

EXPERIMENTAL SETTING

UCLA is currently developing a new financial system. A software package was purchased from a vendor to provide the basic financial capabilities. A campus Work Group was then established to carry out the design work necessary to tailor the purchased software to the UCLA environment. This group consists of computer technicians as well as users and managers from representative departments including administrative, academic, and self-supporting organizations. Even though these major types of departments are represented, it is unlikely that this small user group can adequately anticipate the requirements of all departments. Thus, as each design document is drafted by the Work Group, it is taken to relevant campus units for further review. It is critical that this review process be effective if the resulting system is to be useful.

Recently, the Work Group finished a draft of the new design for tracking and classifying payroll expenses--both a short term and a long term approach were proposed. Since any change affecting payroll procedures may have significant impact on campus departments, feedback was then needed from a larger sample of users to

verify that the proposal was truly beneficial and would not result in unforeseen problems. It was decided that feedback on the design should be obtained by mailing the proposal to a large number of departments for review. The Work Group felt that the written proposal was simple enough to be understood without actual interviews and the mailing would allow a large variety of departments to be sampled.

METHODOLOGY

The setting described above was used to conduct a field experiment. The situation was extremely fortunate and unusual in that extensive control could be exercised over an actual systems effort to allow a true research design. Randomization was possible in both selecting departments and assigning them to treatment groups. It was also advantageous to be able to study user feedback in a real-world environment since software development occurs within complex social systems and organizations. In addition, this study could be unobtrusive; it was to be done within the natural development process and was to be completely invisible to the department users who responded.

The design was a 2 x 2 factorial (shown below) with randomization and equal cell size. It was felt that different department

	Appearance	
	Draft	Finished
Structured (Questionnaire)	21 Academic	21 Academic
	9 Administrative	9 Administrative
	5 Self-Supporting	5 Self-Supporting
Unstructured	21 Academic	21 Academic
	9 Administrative	9 Administrative
	5 Self-Supporting	5 Self-Supporting

types (administrative, academic, and self-supporting) might vary systematically in their responses since they have different types of employees on their payroll. Therefore, stratified sampling was used. A sample of 140 departments was randomly selected from the full list of over 400 departments. These were then randomly assigned to the four treatment groups creating a cell size of 35.

The financial system contact person for each of these departments was mailed the payroll proposal corresponding to its treatment group (either in draft or finished appearance and with or without a questionnaire). All users were asked to respond within two weeks. After this period, follow-up phone calls were made until all users had responded either in writing or by phone (in a small number of cases contacts refused to put their comments in writing).

Treatments

1. Structured versus Unstructured Mode for Response. Those subjects receiving the unstructured response mode treatment were sent the payroll expense design proposal with only a cover letter asking them to review the document and return their written comments to the designers. Those receiving the structured response mode treatment were sent this same design proposal and cover letter and, in addition, a questionnaire. A standard marketing method for constructing a product questionnaire was used to construct this system questionnaire. This required defining the attributes of the system and then formulating questions about each attribute. Several sources were used as guidelines for determining a full set of system attributes (Cooper, 1980; Karni & Beraha, 1979; Pearson, 1977). In addition, the questionnaire consisted of "open" questions so that users could express their feedback in any way they

wished. Thus, both the structured and unstructured response mode were consistent in trying to elicit feedback over the full scope of information systems characteristics..

2. Draft versus Finished Appearance. The group receiving the formal treatment was sent a polished design proposal, perfectly typed and appearing as a finished copy. The other treatment group received the same design proposal presented as a draft. There were hand corrections, the tables were handwritten, and the document was clearly stamped "DRAFT." Only the appearance varied between groups--the content and format of the design proposal remained identical.

Analysis of Feedback

As responses were received, the number of days it took for the user to respond was recorded. This provided a "response time" measure. When all responses were received, content analysis was used to analyze feedback. Three individuals who were familiar with payroll but had not been involved in the design process were selected to be raters. Each independently analyzed the full set of responses and determined the feedback items given by each respondent. Interrater reliability (the percent of feedback items all three raters had in common) was calculated at 76%. A combined list of 62 feedback items was then compiled. This provided a measure of the number or "quantity" of feedback for respondents. At this point, the subcommittee of the Work Group responsible for the original design of the payroll expense proposal met to review the feedback items received. The items and their impact on the design were fully discussed. After this meeting, the five subcommittee members (three users and two analysts) independently rated each feedback item. They were first asked to classify each feedback

item into one of the following four "degree of change" categories. Interrater reliability was calculated at 82%.

1. Corrections (Required Changes)--Changes necessary due to errors, contradictions or omissions.
2. Suggestions (Potential Changes)--Changes that would improve the system from some user or user group perspective.
3. Comments (No Change)--Information or questions having no effect on the design.
4. Not Usable--Feedback that is not understandable or not related to the payroll object code proposal.

Second, these individuals were asked to rate the "quality" of each feedback item using a semantic differential questionnaire. This instrument uses a set of bipolar adjective pairs to evaluate a concept on a variety of attributes. Both Gallagher (1971) and Pearson (1977) have used and validated this method in measuring and analyzing the value of information. The specific semantic differential used to evaluate each user comment follows.

Please rate the feedback in relation to the payroll object code proposal shown below.

The scores on these four scales were used to obtain an individual quality measure for each of the 62 feedback items. This was done by averaging the scores on the four bipolar scales (values 0 to 6) for each rater and then taking the average of the five raters. Thus, the scales and raters receive equal weight.

The non-parametric Kendall Coefficient of Concordance was calculated to investigate the association among the five sets of quality ratings (giving a value of $W = .78$ and a .001 level of significance). This indicated that the raters did not disagree as to the relative quality of the feedback items they were evaluating. These quality ratings for each feedback item were then used to construct two feedback quality measures for each respondent.

1. A total quality of feedback score was determined for each original respondent by summing the quality scores of all the feedback items given by that respondent. This was possible since the rating scales are anchored at zero and assumed ratio.
2. An average quality of feedback score was determined for each respondent by taking the mean of the quality scores of the feedback items given by that respondent.

Superficial	: ____ : ____ : ____ : ____ : ____ : ____ : ____	Insightful
Consequential	: ____ : ____ : ____ : ____ : ____ : ____ : ____	Inconsequential
Valid	: ____ : ____ : ____ : ____ : ____ : ____ : ____	Invalid
Worthless	: ____ : ____ : ____ : ____ : ____ : ____ : ____	Valuable

After these measures of response time, quantity of feedback, and perceived quality of feedback were calculated and recorded, analysis of variance was used to statistically test the hypotheses in their null form. The analysis of variance assumptions were primarily met by the randomization process and the metric scales. However, the assumption that observations are independent could be questioned if department contact persons talked with each other about the design document during the experiment. Employees in the central accounting and payroll offices felt there would be very little communication between departments and that the effect would be minimal. No evidence to the contrary emerged during the experiment. None of the departments who were not solicited for feedback called to ask why. Also, none of the departments inquired about the differences between design documents received (i.e., why some departments received a questionnaire and others did not). Finally, the feedback received

from departments made no reference to other specific departments.

RESULTS

Table 1 shows the degree of change profile and quality ratings of the sixty-two feedback items. The items fall mostly into the comment and suggestion categories. Those feedback items requiring more change were more highly valued by evaluators. Table 2 shows breakdowns of feedback given by respondents in the four treatments. The overall mean shows users submitting about two feedback items with a standard deviation of approximately 1. The structured treatment group submitted an average of 2.2 items whereas the unstructured treatment group submitted an average of only 1.6 items each. The average number of days to respond was 32 with a very large standard deviation (20 days). This seems reasonable since there

Table 1. Degree of Change Profile of Feedback Items

	Number	Percent	Quality Rating of Feedback Items		
			Range	Mean	Std. Dev.
Corrections	4	.06	4.8 - 6.0	5.25	.96
Suggestions	19	.31	2.3 - 6.0	2.32	1.00
Comments	36	.58	0.0 - 4.3	1.71	1.24
Not usable	3	.05	0.0 - 1.5	0.33	.58
Total	62	1.00	0.0 - 6.0	2.13	1.69

Table 2. Means and Standard Deviations of Feedback Items*

Feedback Measure	Structured			Unstructured			Total		
	Draft	Finished	Total	Draft	Finished	Total	Draft	Finished	Total
Quantity of Feedback	2.2 (1.3)	2.2 (1.1)	2.2 (1.2)	1.6 (.8)	1.7 (.8)	1.6 (.8)	1.9 (1.1)	2.0 (1.0)	1.9 (1.0)
Total Quality of Feedback	5.6 (4.2)	6.2 (4.2)	5.9 (4.2)	4.2 (3.6)	4.4 (3.7)	4.3 (3.6)	4.9 (3.9)	5.3 (4.0)	5.1 (3.9)
Mean Quality of Feedback	2.2 (1.6)	2.5 (1.5)	2.4 (1.6)	2.1 (1.7)	2.2 (1.6)	2.2 (1.6)	2.2 (1.7)	2.3 (1.5)	2.3 (1.6)
Response Time (Days)	28.9 (19.8)	24.0 (18.0)	26.5 (19.0)	36.7 (20.9)	39.1 (21.2)	37.9 (21.0)	32.8 (20.6)	31.5 (21.0)	32.2 (20.9)

*Mean (SD)

was a large group of responses submitted very promptly followed by a lull in responses. The remainder came in much later after follow-up phone calls. The structured treatment group had a mean response time of 26.5 days whereas the unstructured treatment group had a mean response time of 37.9 days, an average of 11.4 days longer. The total quality measure had a mean of 5.1 with a standard deviation of 1.6. This distribution had a large number of respondents giving no feedback and also a fairly large number of respondents giving considerable feedback. The structured treatment group had a perceived total quantity of feedback mean score of 5.9 in contrast to the unstructured treatment group mean of 4.3. It is also of interest that 6 of the 7 feedback items requiring system change came from questionnaires.

Tables 3 through 6 summarize the results of the two-way analysis of variance done for each of the four measures. The first three hypotheses test the response mode factor. Research hypothesis #1, predicting more feedback, can be strongly supported (null hypothesis rejected at the .001 significant level). Research hypothesis #3, predicting faster response, can also be strongly supported (null hypothesis rejected at the .001 significance level). Two measures of perceived quality were used to test hypothesis #2. Using total perceived quality as the dependent variable, this research hypothesis can again be strongly supported (null hypothesis rejected at the .014 significance level). Hypothesis #2 was not supported, however, using the average quality of feedback measure. None of the research hypotheses used to test the finished versus draft appearance treatment can be supported. No statistically significant difference between these groups was shown for any of the measures -- response time, quantity, or perceived quality of feedback. The interaction between the study variables was also checked and was not statistically significant. Also, after-

the-fact analysis was done to see if academic, administrative, and self-supporting department types showed systematic differences in response time, quantity, or perceived quality of feedback. No statistically significant differences were found.

CONCLUSION

This study has added to our knowledge about eliciting user feedback in a mail survey situation. The use of a questionnaire response mode to structure the feedback process resulted in significantly more and faster feedback. There is also evidence that the perceived quality of the feedback obtained is better (the total perceived quality measure was significant while the mean perceived quality measure was not). This result can have a major impact on the current system development practices, since questionnaires are now used very infrequently. Most methodologies and practices can be easily changed to include questionnaires at various points during system design and development. This is practical when constructing a questionnaire does not require too great an effort or cost. When these questionnaires are later returned, it may also be easier to extract the relevant feedback. In this experiment, the raters performing content analysis reported that they had more difficulty in determining the feedback from unstructured responses. The questionnaire responses were more direct and easier to decipher. The use of questionnaires in situations similar to this experimental setting is therefore highly recommended.

On the other hand, a difference could not be established between responses made from a draft appearing document and responses made from a finished appearing system document. This result can also impact the current beliefs and practices in information system development. Many designers assume that providing the cleanest and most polished copy possible is the

Table 3. Analysis of Variance Results for Number of Feedback Items

Source	Sum of Squares	df	Mean Square	f	Significance
Main Effects	12.186	2	6.093	5.833	.004
Draft vs. Finished Appearance	0.179	1	0.179	0.171	.680
Structured vs. Unstructured Mode	12.007	1	12.007	11.495	.001
Interaction	.179	1	0.179	0.171	.680

Table 4. Analysis of Variance Results for Total Quality of Feedback

Source	Sum of Squares	df	Mean Square	f	Significance
Main Effects	99.659	2	49.830	3.254	.042
Draft vs. Finished Appearance	5.518	1	5.518	0.360	.549
Structured vs. Unstructured Mode	94.141	1	94.141	6.147	.014
Interaction	1.062	1	1.062	0.069	.793

Table 5. Analysis of Variance Results for Mean Quality of Feedback

Source	Sum of Squares	df	Mean Square	f	Significance
Main Effects	2.663	2	1.332	.516	.598
Draft vs Finished Appearance	.959	1	.959	.372	.543
Structured vs Unstructured Mode	1.704	1	1.704	.660	.418
Interaction	.307	1	.307	.119	.731

Table 6. Analysis of Variance Results for Response Time (Days)

Source	Sum of Squares	df	Mean Square	f	Significance
Main Effects	4603.914	2	2301.957	5.742	.004
Draft vs Finished Appearance	55.314	1	55.314	.138	.711
Structured vs Unstructured Mode	4548.598	1	4548.598	11.345	.001
Interaction	460.828	1	460.828	1.149	.286

preferred and most beneficial approach. The results of this research imply, however, that a finished appearing version may not necessarily elicit any better or faster feedback than a document with a draft appearance. When the content of a document is ready for user review, the analysts may not need to spend extra time and effort to type tables, charts, diagrams, etc., and insure the document appears perfectly polished. More frequent use of such drafts could potentially speed up development without sacrificing the quality of the system.

There are some factors which may have offset any real advantage of a clean copy and account for the lack of difference between respondents of finished and draft documents. Users may be intimidated by formal appearing documents emerging from the systems department or from a user area involved in the system development. There may be a sense that review of a finished appearing document is simply a formality and that the decisions have already been made. Users believing a "rubber stamp" is appropriate may not be motivated to perform a careful review. A document obviously in draft status may give the impression that the designers are truly open to suggestion, and users may be more likely to respond. It should also be noted that while a draft appearing document may not affect the quantity or quality of feedback, it may significantly impact the user's perception of the analyst's competence and professionalism. For this reason, career conscious analysts may prefer finished appearing documents.

Since the study was conducted in only one organization, results may not be generalizable to other environments. However, this experimental setting is typical of many systems development efforts in terms of organizational level of user/managers, the operational type of design document reviewed, and the phase of development where feedback was re-

quested. Thus, findings may be beneficial if applied to these like situations. Differences in results might be expected if the study were replicated in an environment where a high organizational level of user accustomed to unstructured tasks was involved, where the design was in a less defined stage (requiring more conceptual or creative thought processes), and where the type of system being installed was unique.

FUTURE RESEARCH

This is part of a continuing study to investigate feedback elicited during system development. The research presented here focused on the feedback received during the design phase. After the system is fully installed next year, actual user satisfaction can be measured using Pearson's validated semantic differential. Analysis can be done to determine which users are more satisfied--those that gave the best feedback, those whose feedback was used, those who had a structure for response, etc. In addition, satisfaction can be measured for departments which were not solicited for feedback during design. This group can be compared to the group asked for input.

The overwhelming evidence in favor of the questionnaire structure for eliciting feedback in this experiment points up the need for further research in this area. How can the best questionnaire be constructed? What types of structure are to be recommended for obtaining feedback when analysts are present? Also, it is important to establish the generalizability of the results obtained.

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