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ABSTRACT

This paper focuses on the mechanics of assessing the impact of educational technology. The basics of program evaluation, research design, data collection and analysis, and report generation are covered to provide useful information to those responsible for program evaluation research and to decision makers, who are the usual recipients of evaluation reports. The proposed research models focus on the classroom as the location for data collection and analysis for both formative and summative evaluation. It is assumed that the educational technology is static to the classroom, while student movement across the campus is dynamic. Three exhibits contain templates that can be modified for use in research and evaluation studies. Exhibit 1 is the program evaluation template of suggested data elements for use in formative evaluation. Elements for data collection and analysis in summative evaluation make up Exhibit 2, and Exhibit 3 presents a list of suggested discussion items for producing a research/program evaluation report on educational technology. Contains 17 references on research methods, and 13 on statistical analysis. (SLD)

Assessing the Impact of Educational Technology

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Abstract:

This paper focusses on the mechanics of assessing the impact of educational technology. The basics of program evaluation, research design, data collection and analysis, and report generation are covered in this paper. This information is useful to personnel responsible for conducting program evaluation research as well as to decision makers who are the usual recipients of evaluation reports.

Terms:

There are two widely used terms in evaluation research which are rarely defined and therefore often misunderstood: formative evaluation and summative evaluation. In this paper, formative evaluation is best thought of as an evaluation of "processes" (i.e., assessing the status of a district's technology plan), and summative evaluation is essentially an evaluation of "products" (i.e., assessing the impact of technology on student learning, performance, and productivity). Each of these models has its own utility and purpose, as theoretically, each measures a discrete evaluation activity. Since an evaluation study is a research activity, it is most useful to think in basic research terms which can then be applied to producing formative and summative evaluation reports.

Research design easily reduces to a discussion of quantitative and qualitative methods which are used to answer very different and specific types of research

questions. Quantitative studies are normally used to test hypotheses that there are causal (or predictive) relationships between variables being examined. Qualitative studies, on the other hand, are usually exploratory in nature and are most useful for identifying variables that researchers believe may be related.

Based on the research question that is being asked, certain types of data must be collected under controlled/standardized conditions (the research model). According to the literature on research design, research models generally fall into two categories: experimental and quasi-experimental designs. For example, in testing a hypothesis (or conducting an evaluation of a program), an experimental design is the most powerful research model to use. In experimental designs, there is a comparison of an intervention group (experimental group) and a control group, on some outcome measure (usually measured quantitatively). There are ethical considerations when dealing with human subjects in an experimental condition. Well conducted quasi-experimental designs, however, can be quite powerful and are usually the choice in evaluation studies.

Based on the type of data that is collected, certain statistical analyses become available for use. Statistical analyses range from basic descriptions to quite sophisticated multivariate procedures. Each statistical technique has assumptions, which if violated, render the results useless. Generally speaking, descriptive statistics, analysis of variance and chi-squares on nominal or ordinal data, or t-tests on interval or ratio data are sufficient for evaluation studies. These are powerful statistics when applied to data collected from a well designed and executed program (experiment). But still, discretion must be utilized in interpreting results that are statistically significant

but which may or may not be statistically meaningful.

When proposing the development of a new educational program, it is important to document the need for the program, to detail the specific goals and objectives that will be met, to document who and how participants will be served, and to indicate some objective (or subjective) measure of success. A rigorous research design should include: clearly stated hypotheses and operationally defined variables; variables that are clearly manipulated and accurately measured by the researcher; and control or comparison groups to measure effects. An educational program plan should include clearly defined goals and objectives (information necessary for summative evaluation); and an implementation plan should specify project milestones (information necessary for formative evaluation). These are a priori activities to the implementation of the program.

Proposed Research Models:

In the proposed research models, the focus of the data collection activity and analysis is the classroom. Throughout the day, student movement from room to room across the campus is dynamic. In each classroom, students utilize available materials. The proposed research models assume that the educational technology is static to the classroom. Please see Exhibit 1 for presentation of suggested data items that may be utilized in a formative evaluation study. Exhibit 1 can be adjusted for use in situations where educational technology is not static to the classroom.

In Part A, a classroom-level inventory of equipment not only points to age, functionality, and cost (plus repair and/or upgrade), but also allows for this information to be easily summarized to the campus and district levels. In Part B, the curriculum

overlay allows information regarding the courses taught in each of the classrooms, the degree of integration of technology into the curriculum, and actual student utilization of the technology to be cataloged and superimposed onto the inventory list in Part A. By overlaying the curriculum template onto the classroom-level inventory template, one can begin to identify patterns such as: in room X, the equipment is present but is not being used (this may point to needed changes in curriculum); whereas in room Y, the curriculum calls for the use of technology which is not available or adequate for use. The targeted data elements noted in Exhibit 1 may point to solutions as well. Equipment may need to be purchased, repaired or upgraded; there may be a need for staff training to help teachers further integrate technology into the curriculum; or it may turn out that classroom use might need to be rescheduled or that inventories might need to be reassigned. This is the stuff of formative evaluations.

Please see Exhibit 2 for a presentation of suggested data items that may be utilized in a summative evaluation. In this example, a dropout reduction program for at-risk students intends to rely heavily on the use of educational technology for improving reading and math scores (as measured by a standardized test). Other program components such as participation in a mentoring program and increasing participation in school activities will serve to improve students' self-esteem as well. Due to the combination of program activities, the student's overall GPA will improve and students will be less likely to dropout. In this model, a quasi-experimental, pre/post-test only design was selected for use in researching the effectiveness of the program--one component of which was the use of educational technology.

The targeted data items found in Exhibit 2 are based on the major program

objectives used in the example. Based on the research design, data is collected, the program is implemented, and data is again collected at the end of the program. Descriptive statistics, analysis of variance and chi-squares on nominal data or ordinal data, or t-tests on interval or ratio data are then used (as indicated in the research design) in the analysis.

Section Summary:

The result of research-based models such as those outlined above can be used in formative and summative evaluation reports on the impact of educational technology. For example, an assessment of the effectiveness of the at-risk program that utilized educational technology as a program component can be folded into a report that addresses issues related to the overall use and integration of technology into the curriculum. The resulting report constitutes a formative and summative evaluation of the impact of educational technology. The data collection templates (found as exhibits) can be easily modified for individualized use in research/evaluation studies.

Exhibits/Exercise:

Exercise materials are found in a separate document to illustrate the use of Exhibits 1 and 2. For these materials, please contact the author. Exhibit 3 contains the template to be used in producing a research/program evaluation report on educational technology.

Exhibits

Data Collection Templates for use in Assessing the Impact of Educational Technology

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Exhibit 1
Program Evaluation Template
Suggested Data Elements for Use in a Formative Evaluation of Educational Technology

Room:_____

Part A--Inventory List

Equip. Code*	Product	Purchase Date	Repair/ Contract	No.	Unit Cost	Total Cost
	Computers: (specify configuration)					
	Apple/Macintosh					$_____
	IBM and compatible equipment					$_____
	Integrated Learning Systems (specify)					$_____
	Peripherals and Input/Output Devices:					
	CD-Rom					$_____
	LaserDisks					$_____
	UPC Pens					$_____
	External Memory Storage					$_____
	Video Output (PC Viewer)					$_____
	Hard Impact Printers					$_____
	Laser Printers					$_____
	Modem					$_____
	Other (specify)					$_____
	Software: (specify application)					
	Apple/Macintosh					$_____
	DOS					$_____
	Network (specify configuration)					$_____
	Other Educational Equipment:					
	Audio Equipment					$_____
	Video Equipment					$_____
	Distance Learning Equipment					$_____
	TV Monitors					$_____
	Computer Furniture:					
	Tables					$_____
	Desks					$_____
	Chairs					$_____
	Other Costs:					
	Other (specify)					$_____
					Total:	$_____

*Equipment code for inventory control and for use in Part B of this form.

Part B--Curriculum Overlay

Courses taught in this room:	Equip. Code*	Avg. No. Stds.	Percent of Curriculum**	Est. Use by Stds.**	Total Hours**	Percent of Total**

*Specify educational technology utilized for each course taught in this room.
**Separate handout contains the operational definitions and calculations for these data elements.

For more information contact: J. E. Gonzalez at the Texas Center for Educational Research (800)580-8237.

Exhibit 2
Program Evaluation Template
Suggested Data Elements for Use in Summative Evaluation of Educational Technology

Student Data Form, Class/Instructional Program: _____ Teacher: _____ Room: _____

No.	Name	Sex	Ethnicity	At-Risk Indicator[1]	GPA Pre/Post[2]	Reading Pre/Post	Math Pre/Post	Self-Esteem Pre/Post	Activity Pre/Post[3]	Dropout	PC Use[4]
1.	DEN	F	H	H	1.5/2.0	42/45+3	25/30+5	10/15+5	L/L	N	L
2.	BSE	M	B	M	1.5/2.5	11/15+4	19/29+10	17/17=0	L/L	N	H
3.	AST	M	A	L	1.5/2.5	10/16+6	5/15+5	11/13+2	L/L	N	H
4.	RAD	F	A	L	2.0/2.0	29/29=0	38/40+2	18/18=0	L/M	N	H
5.	HES	F	A	M	2.0/2.0	21/25+4	31/40+9	15/18+3	L/L	N	H
6.	ANT	F	A	L	2.0/2.0	17/20+3	25/25=0	13/15+2	L/L	N	L
7.	LED	M	B	M	2.0/2.0	27/25-2	19/23+4	13/13=0	L/L	N	L
8.	NOM	M	O	L	2.5/2.5	23/27+4	13/20+7	13/15+2	L/L	N	L
9.	FOR	M	H	M	1.0/2.5	10/25+15	12/18+6	17/18+1	L/M	N	L
10.	THE	M	H	L	1.0/2.0	25/23-2	14/25+11	10/10=0	M/M	N	H
11.	MOS	F	O	H	1.0/1.5	10/13+3	10/15+5	10/15+5	L/L	Y	L
12.	TER	F	B	H	1.0/1.5	20/22+2	25/28+3	10/15+5	L/L	Y	L
13.	ING	M	B	H	1.0/2.0	17/15-2	9/14-5	10/15+5	M/M	N	H
14.	NTR	F	H	L	2.5/2.0	30/30=0	30/35+5	20/20=0	L/M	N	H
15.	STU	M	H	L	1.5/1.5	25/28+3	9/20+11	13/20+7	L/L	Y	L
16.	ESE	F	H	L	2.0/2.0	16/15-1	15/20+5	13/18+5	M/M	N	L
17.	DED	F	A	H	1.0/2.0	49/49=0	37/37=0	21/20-1	L/L	N	L
18.	IED	M	A	M	1.5/2.0	17/27+10	20/20=0	20/19-1	L/L	N	H
19.	NTS	F	A	H	1.5/2.0	8/14+6	3/13+10	15/20+5	L/L	N	H
20.	VID	M	A	H	1.0/2.0	10/13+3	4/14+10	10/20+10	L/M	N	L

[1] An At-Risk Indicator was constructed based on psycho-social factors: H = high, M = medium, L = low.
[2] For GPA Pre/Post; Pre= data collected spring '91 and Post= data collected spring '92; + or - indicates change.
[3] A School Activity Indicator was constructed based on participation in school-based events: H = high, M = medium, L = low.
[4] A PC Use Indicator was constructed: H = high/effective use, L low/ineffective use.

For more information contact: J. E. Gonzalez at the Texas Center for Educational Research (800)580-8237.

Exhibit 3
Program Evaluation Template
Suggested Discussion Items for Use in Producing a Research/Program Evaluation Report on Educational Technology

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A research/program evaluation report should contain:

Cover Page
- Program Evaluation Report Name:
- Program Evaluator:
- Date Report Submitted:
- Submitted to:
- For the Period:

i. Executive Summary or Abstract
- Write this section last, but think about it first!!!
- Use the "best line" from each of the following sections.

ii. Table of Contents

1. Background Information
   - A. History of the program, needs analysis used as rationale for program.
   - B. Goals/Objectives of the program.
   - C. Program features (who and how served).
   - D. Narrow the focus of the discussion to the items to be evaluated.

2. Evaluation Study Description
   - A. Identify the theoretical framework used as basis for the program.
   - B. Discuss previous research studies used as models for the program.
   - C. Describe the research protocol for the conduct of the study:
     1. period of study
     2. measures and outcome measures
     3. specific statistical techniques
     4. potential weaknesses/limitations in the design, based on: theoretical framework for the program and previous research models.

3. Results
   - A. Results discussed in the context of the weaknesses/limitations in the design.

4. Discussion of Results
   - A. If the results were okay, and the design was okay, then it is plausible that effects seen are real effects: statistically significant and meaningful.

5. Recommendations

6. References/Resources
   Appendices

For more information contact: J. E. Gonzalez at the Texas Center for Educational Research (800)580-8237.

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