

## PROTOTYPE FRAMEWORK: PROTOTYPES, PROTOTYPING AND PILOTING IN TERMS OF QUALITY INSURANCE

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### ABSTRACT

*There is always a great uncertainty as to whether a new concept, model, or design—products from industry and assessment tools from education, will actually do what is desired. The quality of product is based on prototype, prototyping and piloting. The idea of prototype, prototyping is being incorporated in the development of educational assessment tools. Prototype is something that is representative of a category of things; it is early sample, model, or design built to test a concept or process. It is an original type, or form of something serving as a typical example, basis, epitome, or standard for other things of the same category. A prototype—sample test or sample test item, is built to test the function—assessment of performance, abilities or proficiencies, of the newly developed assessment tool, before using the test in students' assessment project. Developing valid test is often expensive and can be time-consuming, especially when repeated several times. As an alternative, "rapid-prototyping" techniques are used for the initial prototypes, which implement part—test items related to different constructs or various parts of a product, but not all, of the complete test. Prototyping is a process of quickly putting a prototype in order to test various aspects and features of an assessment, and gather early user feedback. Prototyping is often treated as an integral part of the assessment tools development process, where it is believed to reduce project risk and cost. Initially often one or more prototypes are made; in this way problem or deficiencies in assessment tool can be corrected. This allows manufacturers—industrialists or assessment organizations to rapidly and inexpensively test the parts of the product/assessment that are most likely to have problems, solve those problems, and then develop the assessment tool. When the prototype is sufficiently refined and meets the standards—benchmarks or objectives, the product—test is ready for production. Before going to use test, piloting help to make sure all types of evidences of validity—construct validity, result interpretive validity and usability. These validity evidences may guide the teacher about consequences of test results. Thus notion of prototype and prototyping has changed and shifted the idea of traditional assessments towards valid and marketable assessment tools.*

**Key words:** *assessment, prototype, prototyping, performance, assessment tools*

### INTRODUCTION

In many fields—industry and education there is always a great uncertainty as to whether a new concept, model, or design—products from industry and assessment tools from education, will actually do what is desired. Building the full—complete in all respect, design can be time-consuming and much more expensive. These two factors have deep affects on require product, especially when product is repeated several times. A prototype (proto means initial/first and type means version/category/sample) is the first working model which serves as a model on which successors are based. It is built to test the function of the new design before starting production of a product. The most common use of the word prototype is a functional. A parallel word “Service Test” is used in aviation and aircraft industry in place of prototype. The quality of product is based on prototype,

prototyping and piloting. Prototypes provide the design developers with a "working model" for demonstration of product analysis, quality-assurance, to confirm or make changes according to needs and requirements.

Prototyping is the process of quickly putting together a working model in order to test various aspects of a design, illustrate ideas or features and gather early user feedback. Prototyping is often treated as an integral part of the product design development process, where it is believed to reduce project risk and cost. Often a few prototypes are made initially and each prototype is influenced by the performance of previous designs, in this way deficiencies in design of the product can be corrected. When the prototype is sufficiently refined and meets the functionality, robustness, manufacturability and other design goals, the product is ready for production. The idea of prototype, prototyping is being incorporated in the development of educational assessment tools.

### **Concept and Purpose of Prototype**

According to Fulcher and Davidson (2007) The Oxford Dictionary of Business (1996: 407) defines the prototype in this way:

*“A preproduction model developed to evaluate the feasibility of new ideas, materials, technology, and techniques as part of new product development. In addition to the technological evaluation, consumer clinics may be used to establish the opinion of the potential customers on the acceptability of the product”.*

The purpose of prototype in testing is similar to its purpose in engineering. The main objective of prototype is to construct an item, for a test, that is aligned with the purpose of the test and justification for the selection of item for test.

### **Significance of Prototypes and prototyping in Educational Testing**

Today main goal of students' assessment is to assess *“Knowing What Students Know* provides us with a compelling view of the future of educational assessment, a future that includes better information about student learning and performance consistent with our understandings of cognitive domains and of how students learn. That future also promises a much tighter integration of instruction and assessment. Realizing these ambitions depends on progress in the fields of cognition, technology, and assessment, as well as significant changes in educational policy at local and national levels (Technology and Assessment: Thinking Ahead -- Proceedings from a Workshop, 2002)”. In educational testing, it is most important to unmask the constructs that are the targets of assessment. What do we mean by the unmasking of constructs and why is this important? Standardized assessments have often been characterized as irrelevant and arcane to the test taker. ETS experts have the view that most of the International standardized Tests are problematic, in part, because task types such as analogies are puzzle-like, limited in scope, and not directly linked to any frameworks. Thus, contends that preparing for such tests distracts students and teachers from focusing on the important learning goals articulated in content standards and access to the secrets of these tests is not equitably distributed in all societies.

Such criticisms are not unique, and they point to a historical problem with traditional tests—the masking of constructs, that is, a lack of clarity of the meaning associated with performance. On high

stakes tests, such ambiguity causes overwhelming attention to particular task types and to test questions themselves.

To make the constructs underlying standardized assessments more transparent to students and teachers, with the goal of altering the focus from the tasks themselves to the constructs they measure. Prototype for a new educational assessments are being used in modern digital age to evaluate the all types of validity, perceived authenticity, and educational appropriateness of these prototype for assessing students achievements and proficiencies in different subjects. The developer of an assessment item as prototype must explicitly consider the following:

**The Domain**—what concepts and skills constitute the domain, how are the various components related, and how are they represented? The domain representation becomes the vehicle to communicate, through the assessment process, the valued nature of understanding.

**The Evidence**—what are the data that would lead one to believe that a student did, in fact, understand some portion of the domain model? What would a student have to demonstrate to show that he or she could perform at a designated level of accomplishment? Clarifying what the evidence should be is important, not only for the shaping of tasks but also to help students understand in very clear ways what is expected.

**The Tasks**—In light of domain and evidence requirements, assessment tasks can be developed. If the tasks are driven by such requirements, there is a much greater likelihood that the tasks will be focused, relevant, and representative. Note that the path of moving from domain, to evidence, to task is quite different from many traditional test-development practices

These—the domain, the evidence, and the tasks, three constitute Evidence Centered Design framework. The tasks or items are the components of an assessment or test. Each item is the prototype for the test.

### Example (Language Testing)

Circle the odd word.

1. Water
2. Milk
3. Petrol
4. Ice
5. Coffee
6. Jam-e-shireen

An expert in language assessment may have following question about this item as a prototype item.

- What the teacher think the item is supposed to measure?
- What knowledge would a student need to answer this item?
- Is there any problem with this item? If yes then what?
- How can improve the item?

All these questions are related to the validity and quality of the test.

The answer of first the question is related to the item specification and then to the objective of the test. The answer of second question is related to the instruction while question 3<sup>rd</sup> and 4<sup>th</sup> are related to the test development. Here we can discuss only 3<sup>rd</sup> and 4<sup>th</sup> question.

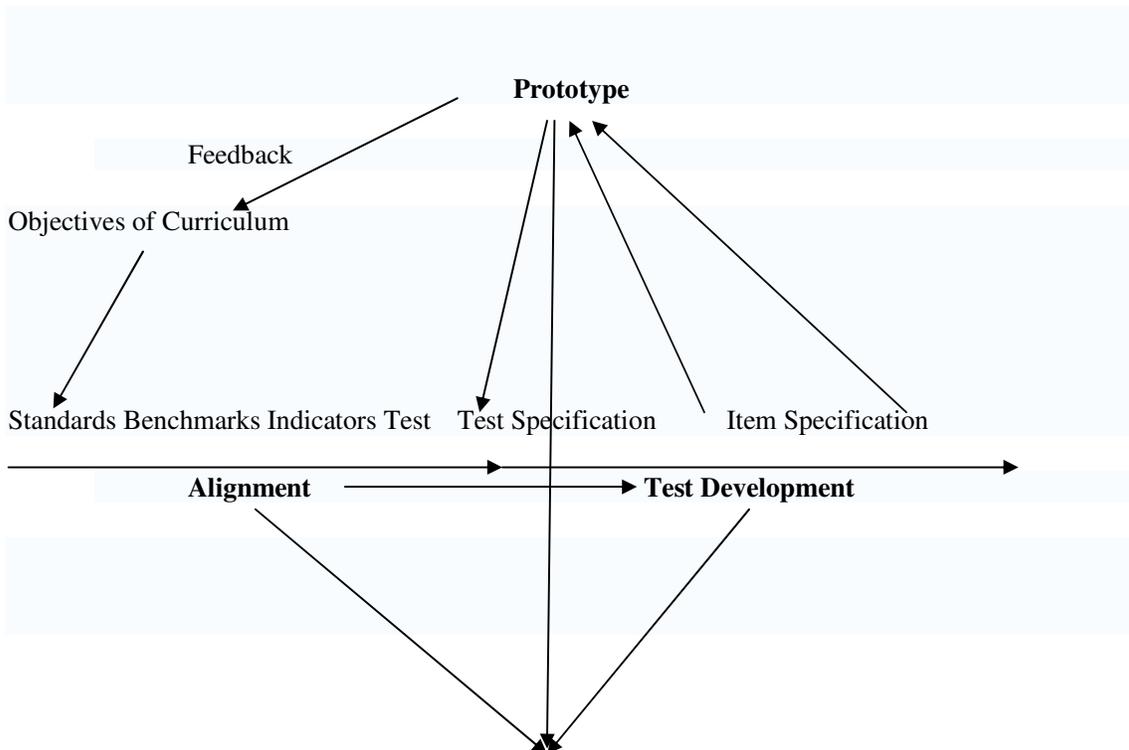
There is a problem with this item. In Pakistani society, especially in rural areas small children have no idea about coffee and jam-e-shireen even there are so many children that have never been seen coffee or jam-e-shireen. So this would influence item difficulty resultantly validity of the test in large scale assessment. This item may be improved by replacing coffee by *lussi* (mixing of yogurt + water) and adding word *shurbat* (mixing of jam-e-shireen + water).

The analysis of prototypes help the item writers in solving the issues related to:

- Cultural content
- Construct-irrelevant processes
- Claim we wish to make
- Expected difficulty drivers
- Assumptions
- Format and presentation
- Construct-irrelevant variance
- Context
- Correct response

**Prototype Framework**

Below framework explore the importance of prototype

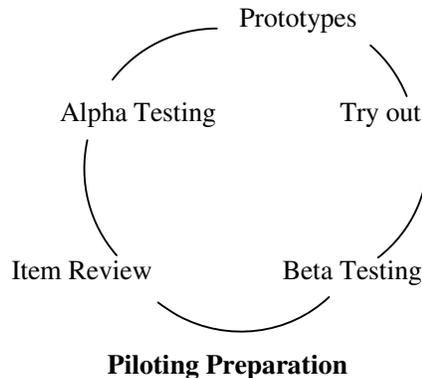


## Valid Assessment of Students Performance

Prototypes authenticate validity of assessment. Standards, benchmarks and indicators are the bases of test and item specifications. Test and item specifications lead towards prototypes. Prototypes give feedback to curriculum objectives and Standards, benchmarks and indicators. Therefore prototypes are the mediators between test alignment and test development.

### Prototyping

Prototyping forms an important link between theory and practice. It transforms ideas into practical form. It strengthens the piloting and field studies.



#### 1) Alpha Testing

It is in-house testing (Fulcher & Davidson, 2007). The purpose of alpha testing is to remove faults/errors in stems, options, item context etc through expert judgment. Every item is review by experts' individually and by group of experts.

##### Item Review

The group leader—chief conduct item review by cross item reviewing among item writers. Faulty items will be revised by the item writers. Finally all the items are reviewed by the chief.

##### Panel Item Review

All item writers meet and review all prototypes items by the assistance of item writing experts, Psychometrician, subject teachers, and personals from testing service

#### 2) Beta Testing

The purpose of beta testing is to test items with students of specified subject and grade. Beta testing use to ensure expected difficulty level, discrimination, and test format.

**Try out/spot testing**

The items selected by panel review tryout—spot testing, on small number of students. All items are divided in to small groups of items (approximately 10-20). Each group of item is tryout on five to ten students only.

**Tryout Data Analyses**

Main purpose of data analyses of tryout data is to check the quality of items according to the contents and competencies to be assessed.

**Piloting**

A pilot study is a standard scientific tool for research that allowing researcher to conduct a preliminary analysis before committing to a full-blown study. Therefore a good assessment or research strategy requires careful planning and a pilot study will often be a part of this strategy. A pilot study is normally small in comparison with the main research and therefore can provide limited but appropriate information on the sources and magnitude of variation of response measures.

A pilot study may address a number of issues. As part of the research strategy the following factors can be resolved prior to the main study:

- Check that the instructions given to investigators comprehensible;
- Check that investigators and technicians are sufficiently skilled in the procedures;
- Check the correct operation of test;
- Check the reliability and validity of results
- Detect a floor or ceiling effect (e.g. if a task is too difficult or too easy there will be skewed results)

**Advantages of prototyping**

- Assists to identify any problems with the efficacy of earlier design, requirements analysis and coding activities
- Helps to refine the potential risks associated with the delivery of the system being developed
- Early visibility of the prototype gives an idea of what the final assessment looks like
- Cost effective (Development costs reduced)
- Increases system development speed
- Fully functional testing before any commitment to tooling(Fulcher & Davidson, 2007)
- Encourages active participation of students
- May attract funding
- Enables a higher output for funding agencies

**Disadvantages of prototyping**

- Possibility of causing systems to be left unfinished
- Possibility of implementing systems before they are ready.
- Project management difficulties

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