

Punarjjani™ - A web based tool for assessment of mental retardation in children

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ABSTRACT

A child with mental retardation (MR) undergoes a comprehensive evaluation to assess the nature of services required for her / his improvement. Assessment, evaluation and programming a child with MR based on the inputs from the interdisciplinary team of doctors & rehabilitation professionals is a challenging task for special teachers. Following evaluation, collected data is translated into statements of special education needs. Special teachers use various scales & checklists for assessment, but the process currently followed in India is primarily manual. Thus, the special educator has to spend much of his / her time for writing reports, drawing graphs / charts etc. Reference to past records and micro level analysis of children is another challenging task in the manual system. 'Punarjjani™', the software tool developed by Media Lab Asia in collaboration with Centre for Development of Advanced Computing (C-DAC), is an attempt for solving these issues. It is a web based integrated assessment tool for MR children, conforming to the Indian practice. The system follows the principle that assessment is the first necessary step in program planning of child, followed by the designing of Individualized Education Plan (IEP). Algorithms are drawn from the manual process which is currently followed. The tool suggests the strength and needs of each child, based on the inputs. Areas where sufficient independence is achieved, areas which are to be strengthened and problem areas are identified for each person. Based on this analysis, optimal long term goal and short term objectives are identified and suitable lesson plan is recommended for each child from repository. A reference library integrated with tool, assists special teachers forming new lesson plans as per standard format, which are added to repository. A grouping algorithm incorporated in the tool helps to create homogenous groups for group teaching of MR children. The software is a great help to special educators to arrive at a comprehensive picture of an individual's performance level in adaptive behaviours. Tool has been field tested with around 500 special schools across the country.

CCS Concepts

- Software and its Engineering → General programming language → Language types → Object oriented language
- Software and its Engineering → General programming language → Language features → Abstract Data Types, Polymorphism, Inheritance, Control Structures, Data Types and Structures, Classes and objects, packages, Patterns, Co-routines
- Software and its Engineering → General programming language → Formal language definitions → Syntax, Semantics
- Software and its Engineering → Compilers → Interpreters, Just-in-time compilers, Runtime environments, Preprocessor, Parser
- Software and its Engineering → Context Specific language → Markup languages → XML, Hypertext language
- Software and its Engineering → Context Specific language → API languages
- Software and its Engineering → System description languages → UML
- Software and its Engineering → Development framework & environments → Object oriented frameworks, Software as a Service, Integrated & visual development environments
- Software and its Engineering → Software creation & management → Designing Software → Requirements analysis
- Software and its Engineering → Software creation & management → Software development process management → Software development methods → Rapid application development
- Software and its Engineering → Software creation & management → Software development process management → Software development techniques → Software prototyping
- Software and its Engineering → Software creation & management → Software development process management → Software verification & validation → Process validation → Walkthroughs, Use cases, Acceptance testing
- Software and its Engineering → Software development techniques → object oriented development
- Information Systems → Database management system engines → Database query processing → Query optimization, Query operators, Query planning, Join algorithms
- Information Systems → Database management system engines → Parallel & distributed DBMSs, Trigger and rules, Database view
- Information Systems → Query languages → Sql

- Information Systems → Query languages → XML query languages → XPath, XQuery
- Information Systems → Query languages → Middleware for databases → Database web servers, Application servers
- Information Systems → Web services → SOAP, RESTful web services, WSDL, UDDI, Service discovery & interfaces
- Human Centered Computing → HCI → Interaction paradigms → Graphical user interfaces, Web-based interaction
- Social and professional topics → Computing education → Computing education programs → Student assessment
- Social and professional topics → User Characteristics → Age → Children

Keywords

Evaluation; Assessment; Mental Retardation; Tool; IEP; Checklist; MDPS; FACP; BASIC-MR

1. INTRODUCTION

As per Census of India 2011 data, 2.21 percent of total population is Persons with Disabilities (PwDs). Out of this 5.62 percent are persons with MR i.e. around 1.5 million. Out of this 0.27 million are children with MR in age group 5-19 Years. Only 5 to 10 percent of the total disabled population receive any form of rehabilitation support and / or special education services in India. At present, there are over 3500 special schools in India, of which about 1000 are exclusively for children with MR.

According to the definition by Persons with Disabilities Act 1995, enacted in India, mental retardation means a “condition of arrested or incomplete development of mind of a person which is specially characterized by sub-normality of intelligence”.

Adaptive skill areas are those daily living skills needed to live, work, and play in the community. Adaptive skills are assessed in the person's typical environment across all aspects of an individual's life. A person with limitations in intellectual functioning who does not have limitations in adaptive skill areas may not be diagnosed as having mental retardation. Children with MR have significant problems in the area of learning and adaptive behaviors such as activities of daily living, communication, mobility, etc. Education for these children involves provision of special education, often in a special school setting.

2. USER ENVIRONMENT

The pedagogy, admission, teaching, evaluation and promotion to the next level in special schools, are different from normal schools. The method adopted in special schools is known as IEP (Individualized Education Program), in which each child is taught based on a separate syllabus, drawn based on his / her capabilities.

The process of admission starts with preparing a 'Case Record' of the child with the help of the parents or the guardian of the child. The case record contains details of the child including pre and post natal details, pedigree details, details of his / her attitudes, health details etc.

A child with MR undergoes a comprehensive evaluation to assess the services required for his / her improvement. Evaluation is done for 3 purposes: diagnostic, instructional, and progress monitoring. Following this evaluation, collected data is translated into statements of special education needs. Both criterion-referenced (or teacher made tests) and standardized tools are used for this purpose. Functional Assessment Checklist for Programming (FACP), Behavioral Assessment Scales for Indian Children with Mental

Retardation (BASIC-MR), and Madras Developmental Programming System (MDPS) are widely used standardize tools in India for evaluation and programming a child with MR[3][4][5][10].

These tools are used by the special teachers to assess the person with MR, so as to arrive at a picture of individual's performance level in adaptive behaviors will be followed by the individualized program plan persons will undergo periodic evaluation to determine the effectiveness of the program[3][4][5].

All these are currently done as a manual process. Special teachers spends a major chunk of their time for writing reports, drawing graphs and writing lesson plans etc[8][9]. Moreover, they have to compile manually hundreds of data sets to arrive at a decision about individual's level of performance. The huge volume of data makes it challenge to refer to the past data manually optimum decisions.

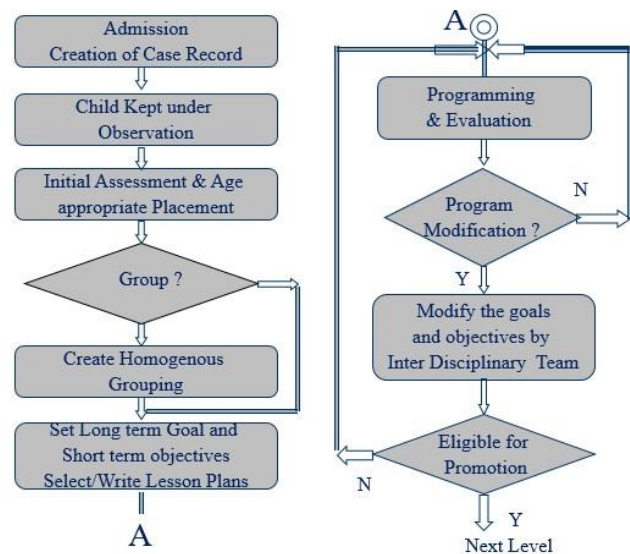


Figure 1. Work Flow in Punarjjani™

3. FROM MANUAL PROCESS TO WEB BASED TOOL 'PUNARJJANI™'

'Punarjjani™', the web based software tool provides an easy to use integrated environment of various popular manual scales & checklists to assess & evaluate 6-18 years of children. The aim was to introduce the power of Information Technology (IT) in the current manual system to improve the efficiency of the system and the effectiveness of special education.

The tool provides a comprehensive assistance to the special teachers at all the stages from admission of the children, initial evaluation, age appropriate placement, setting the long term goal for the child, splitting the long term goal into achievable short term objectives, creation of lesson plans, term wise and year wise evaluation etc[6][7].

The major advantages of the web based tool can be summarized as below:

- (1) Case history, details of every assessment and evaluation of every individual, is kept as digital data that facilitates easy access of every detail, past & present.
- (2) Provides a comprehensive picture of the adaptive behavior of an individual
- (3) The tool analyzes and suggests an optimal long term goal and short term objectives for every individual

- (4) The tool identifies strength & needs of the individual through analysis of the past evaluation results
- (5) It suggests a homogenous grouping of children for group teaching
- (6) It generates custom and analytical reports and graphs which are printable
- (7) It contains a scalable repository of lesson plans and reference library to be used by special educators.
- (8) It reduces 40-45% manual labor of the special teachers



Figure 2. Punarjjani™ Screenshot

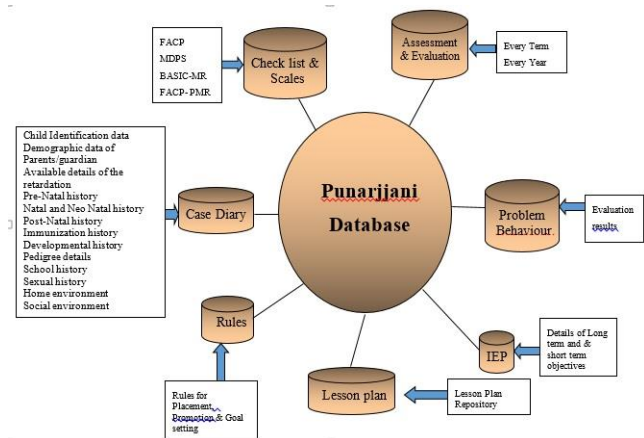


Figure 3. Punarjjani™ Database

4. INNOVATIONS

4.1 Grouping Algorithm

The tool facilitates special teachers to create homogeneous groups for group teaching. The children in each level such as pre-primary, primary, secondary, pre-vocational etc. may be grouped into suitable size (up to 8) as decided by the special teacher. The grouping is done by analyzing the performance of each child taking into consideration of the preference weightage of the daily living activities.

Homogeneous grouping is the placement of students of similar abilities into one group. Although there may be a variations of

abilities in Homogeneous Group, it is much less than the variations found in the heterogeneous classroom.

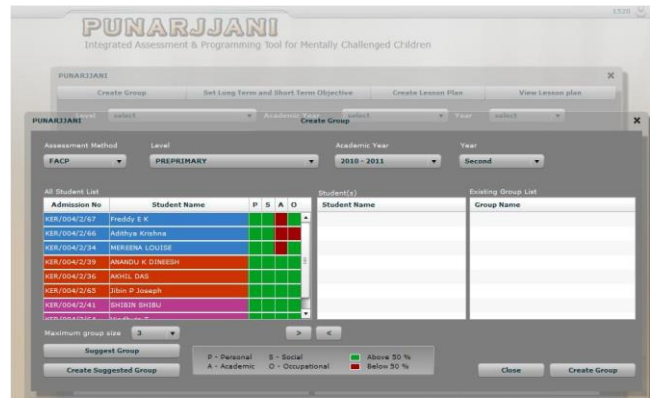


Figure 4. Students Grouping

4.2 Algorithm to find Strengths & needs

Punarjjani uses a unique algorithm to find the strength & needs of each individual child. It analyzes the previous 3 consecutive evaluations to find out the area in which the child is weak and in which area the child is independent. This data is plotted in a graph of 16 areas of daily living activities. This knowledge of strength and needs of an individual is utilized while setting the long term goal and short term objectives of child.

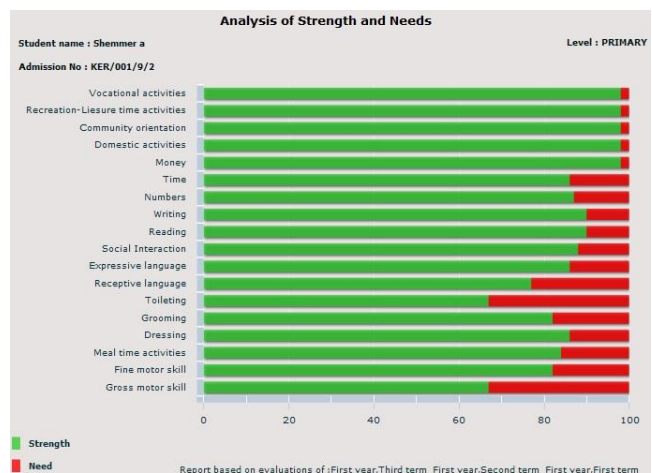


Figure 5. Strengths & needs report of a child

4.3 Inference Engine

The tool has an inference engine which makes an inference of each individual by trying to answer following questions:

- What is the level of his / her disability (Mild, Moderate, Severe, Profound)?
- What are the skills that he / she has already acquired?
- What is his / her present level of functioning?
- Other considerations such as age, associate disability, strength and needs

Using this inference, the tool can separate the activities as items with complete independence, items which require occasional cueing and problem areas. The tool also suggests the next long term goal and its short term objectives. The items which require

occasional cueing is suggested as strengthening in the next stage. It also suggests suitable lesson plans from the repository.

5. MODULES

5.1 School Registration Module (SRM)

This module deals with the registration of a new School, its details entry etc. The design of this module is done considering national scenario. A school is allowed to use the tool only after registration approval.

5.2 Child Registration Module (CRM)

When a child with MR joins the school, a Case Record is made with following details:

- (a) Child Identification data
- (b) Demographic data of Parents/guardian
- (c) Available details of MR
- (d) Pre-Natal history
- (e) Natal of Neo Natal history
- (f) Post-Natal history
- (g) Immunization history
- (h) Developmental history
- (i) Pedigree details
- (j) School history
- (k) Sexual history
- (l) Home environment
- (m) Social environment

CRM facilitates special teachers to record all the above details, generate case record, placement of child in an appropriate level (Pre-primary, Primary, Secondary, Pre-occupational etc.) vis-vis to his / her age.

5.3 Child Assessment Module (CAM)

All the children, who join the special school, are kept under observation for (Normally) 2 weeks. After observation, the child is evaluated to find out his / her level of knowledge / capabilities. Similarly, at the end of each term a student undergoes an evaluation to ascertain the progress made and to decide whether the program / teaching required modifications. This module facilitates initial evaluation & term wise evaluations. It also helps in generating progress reports & graphs.

5.4 Child Goal set Module (CGM)

In Individual Education Program (IEP), each student has a long term goal set based upon his / her individual needs, level and capabilities. The long term goal is further divided into short term objectives. Each short term objective consists of a number of specific areas. On each specific area, a lesson plan and teaching strategy is generated. CGM helps special teachers in setting long term goals and short term objectives for each student with MR. The system also suggest appropriate lesson plan from a built-in lesson plan repository.

6. UNIQUE FEATURES

- Accessible to all special schools throughout the country round the clock through Internet
- Easy store and retrieval of assessment data
- Automatic generation of charts and graphs on child & class's progress
- Uniformity in assessment method
- Statistical analysis and prediction

- Development pattern for every individual child
- Improved individual programming strategies
- Video help files integrated

7. FIELD EXPERIENCE

- 21 training workshops conducted at Delhi (5), Ahmedabad (1), Kochi (2), Mumbai (2), Kolkata (1), Bhopal (1), Hyderabad (1), Chennai (1), Madurai (1), Panipat (2), Pune (1), Guwahati (1), Coimbatore (1) and Hooghly (1)
- 820 special teachers representing 485 special schools & 122 Sarva Shiksha Abhiyan (SSA) blocks trained

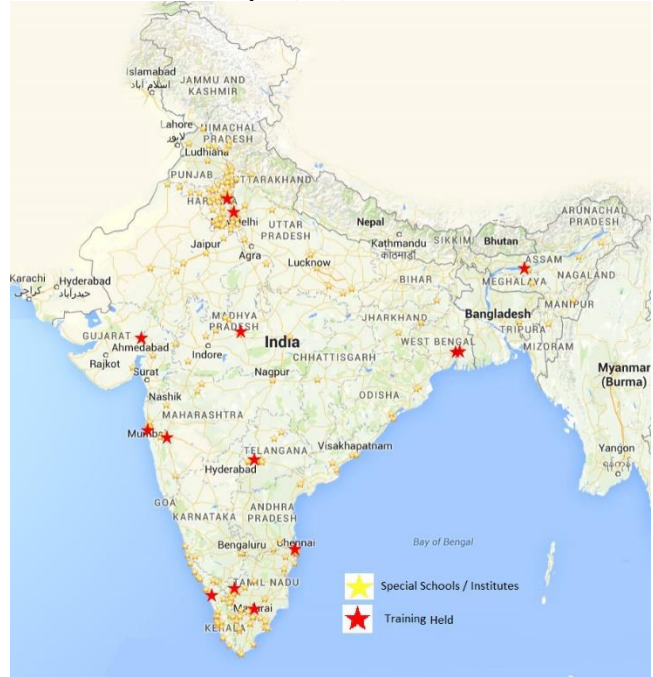


Figure 6. Field deployment of 'Punarjani™'

8. TESTIMONIALS / FEEDBACK

Some testimonials on tool are as follow:

- "Excellent tool for MR students" – Mr. Malay Chakraborty, Shelter School, Hooghly (WB)
- "It is very helpful to us for children" – Ms. Piyali Das, REACH Special School, Kolkata (WB)
- "An ICT based integrated assessment tool is great help to us" – Dr. Usha Grover, NIMH regional centre, Delhi
- "Very useful for the special children data creation" – Ms. Z. Sithi Ramzon, Madurai, Tamil Nadu
- "We are very grateful to have Punarjani™ for educational planning of the children with disabilities. With the software we can find out individual and overall achievements of students of our school" – Ms. Sheena P.G., Principal, KVM School for Mentally Handicapped, Cherthala, Kerala
- "Helps teachers for planning & implementing the individual education program to the child with MR. Reduces the subjectivity in evaluating a child and helps for optimum planning." – Sr. Telsa Paul FCC, Principal, San Joe Sadan school for the MR, Cherthala, Kerala
- "I convey our thanks to the team behind 'Punarjani™' for developing a software in the field of MR, the first of this kind in

India to my knowledge. The findings & results given by 'Punarjjani™' has been very consistent with the manual findings. The planning & implementation of education program has been drastically improved with the use of the software, with minimum manual intervention." – Sr. Prasanthy CMC, Principal, Deepthy Special School, Alappuzha, Kerala

However, most of the schools trained & provided access to tool has abandoned it due to movement of trained teachers to general public schools or other professions.

9. SOCIAL & ECONOMIC IMPLICATIONS

- Enables special teachers to do easy & quick assessment of children in structured way and hence saves their time
- Teachers can devote more time with children in developing their skills
- Reference books (having examples of around 4000 lesson plans) integrated with the tool helps in building expertise in teachers in the areas of development of lesson plans
- Data collected from each school may be utilized for further research and social policy formation

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12. DISCLAIMER

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