Improve the Education System in Saudi Arabia

SELP 695 Systems Engineering Integrative Project

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Introduction

- Education is the foundation upon which a society develops because it teaches our future generations. Education is vital, especially for our young children: any civilization's most precious resource. Education always needs to improve to stay competitive with international rivals.

- In 1985: the total budget for education (schools, curriculum, universities, colleges and the Ministry of Education) was US$ 8 billion; this amount constitutes 3.6 percent of the total budget for Saudi Arabia\(^1\).

- Today, more than 70 percent of the population is under 30 years old\(^2\).

Introduction

- In Saudi Arabia, the education system is very archaic. The current school system was introduced during the industrial revolution when an unskilled workforce was needed: one with basic literacy and numeracy skills that would do as they were told.

- Investment in the quality of education necessitates the development of educational research and of measuring instruments in particular. These factors include the characteristics of both pupils and teachers and the specific features of the family and school environment.
Problem Statement

The three corners of a triangle education system are:

- School
- Educational Curriculum
- Teacher
Problem Statement

- **First corner Is School:**
  - To transfer student, first get approval letter from new school.
  - Family takes approval letter to current school.
  - Family gets students documents from current school.
  - Family takes student documents to new school and enrolls student.

- **Second corner Is Educational Curriculum:**
  - Students face a delay in receiving hard copies of the textbooks.
  - Students might not have access to the right person who can help him with the lessons that he missed.
  - Recently, it has been discovered that many of teachers work as private tutors, and they are totally unqualified to teach anything at all.
Problem Statement

- **Third corner Is Teacher:**
  
  - A teacher should have three major qualities: background knowledge, professional skills, and personal qualities. Teacher has a big role in the educational life of a student.

  - The Ministry of Education in Saudi Arabia should select carefully from the large numbers of teacher candidates.

  - The education system has been criticized for "poorly trained teachers, low retention rates, lack of rigorous standards, weak scientific and technical instruction!", despite generous budgets.

Project Objectives

- **First corner (school):**
  - The system provides online school guides, since it is important to obtain information on schools in your area.
  - The system reduces the time required to transfer the student's documents.

- **Second corner (educational curriculum):**
  - The system creates and makes available educational resources on competency-based learning. These resources might be best practices, rubrics or tools, or research.
  - The system leverages the internet to create online tools and resources that offer innovative teaching strategies to help engage students.
  - The system helps teachers to understand and practice authentic teaching and learning to help students master skills and standards.
Project Objectives

Third corner (teacher):

- The system provides an efficient and fair way to select and nominate for the post of teacher.
- The system helps to nominate qualified teachers who will affect the educational process and the productivity of the community.
- The system creates a technical solution for flexible tracking of competencies and credits.
Interrogatives

- **Who:**
  Stakeholder (families, students, prospective teachers, the Ministry of Education)

- **What:**
  The project will be the creation of an online educational services system in which information about schools, curriculum, and online tutoring will be made available in order to increase the educational services.

- **When:**
  The online educational services system will be made ready by August 2017, in order to provide the population with time to get familiar with its components.

- **Where:**
  The program is proposed for the Ministry of Education, Kingdom of Saudi Arabia.

- **How:**
  ✓ The system will include information about all students that are registered in the Ministry of Education, as well as the issues they are presenting in their profiles.
  ✓ The system will have the curriculum of all school levels: elementary school, middle school, and secondary school, or high school, and online tutoring for these curricula.
  ✓ The main portal of the website will allow the stakeholder to carry out their services from the convenience of their personal computer or mobile device.
Interrogatives

Why:
The society needs this project for the following reasons outlined in the table below:

- **School:**
  - Transferring the student's official documents manually makes them vulnerable to loss or damage.
  - There are almost always considerable distances between the two schools.
  - This long process takes time and effort.

- **Educational curriculum:**
  - Missing one lesson may cause a student to fail to understand a particular concept.
  - The student might not have the right person to help with the lessons that he missed while absent. Also, the student's parents may be illiterate.

- **Teacher:**
  - The perception toward teaching as a profession needs to be enhanced to encourage people with high competencies to consider teaching as one of their future choices.
Background

• Saudi Arabia depends heavily upon its oil revenues to achieve economic development and a prosperous life for its citizens.

• Only a small percentage of the budget, however, is devoted to educational and healthcare improvements. The Kingdom needs devote more resources and care into improving the defective educational system.

• Even though the average annual budget of 3.7 billion dollars for education in Saudi Arabia over 40 years was accompanied by roughly a 9 percent increase in education expenditures, the education sector remains incapable of satisfying the demand for skilled employees according to the government’s Saudization objectives.

Background

Male Students total based on degree level, 2010

Female Students total based on degree level, 2010

System of Systems
System Requirements

Functional Requirements

1. The System shall verify on a regular basis responsible user ID and location.

2. The system shall offer information about all the schools in Saudi Arabia (the location, the number of students in a school, etc.)

3. The system shall provide the Human Resources Department at the Ministry of Education with accurate data about prospective teachers.

4. The system shall update the database that houses the schools listing information yearly.

5. The system shall provide software copy of educational curricula.

6. The system shall provide an online tutorial to allow students to practice.
Alternative Solutions

School System

- In this system, the essential fundamental is that all records of the students, prospective teachers and all sorts of information be sent to the servers of the school. The system will be operating inside the school and they will have their own servers.
- The Ministry of Education will be the monitor on all schools and will require the schools to change their system from paper system to electronic system.
Alternative Solutions

Developing Educational Life System.

- In this system, the essential fundamental is that all records of the students, schools (public and private), prospective teachers, the curricula of all school levels and all sorts of information are sent to the administration (Ministry of Education).
- The Ministry of Education will build a database to collect the information of the students and connect it to the Ministry of Education, Schools.
Alternative Solutions

In this case, we will allow the current systems to remain as it is.
## Analysis of Alternatives

<table>
<thead>
<tr>
<th>MOEs</th>
<th>School System</th>
<th>Developing My educational Life System (MDL)</th>
<th>Do nothing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost of Implementation</strong></td>
<td>Medium (2)</td>
<td>Low (1)</td>
<td>High (3)</td>
</tr>
<tr>
<td><strong>Connectivity</strong></td>
<td>Medium (2)</td>
<td>High (3)</td>
<td>Low (1)</td>
</tr>
<tr>
<td><strong>Performance</strong></td>
<td>Medium (2)</td>
<td>High (3)</td>
<td>Low (1)</td>
</tr>
<tr>
<td><strong>Ease of Implementation</strong></td>
<td>Medium (2)</td>
<td>Low (1)</td>
<td>High (3)</td>
</tr>
<tr>
<td><strong>Social Benefit</strong></td>
<td>Medium (2)</td>
<td>High (3)</td>
<td>Low (1)</td>
</tr>
<tr>
<td><strong>Total MOEs Score</strong></td>
<td>10</td>
<td>11</td>
<td>9</td>
</tr>
</tbody>
</table>
## Risk Management

<table>
<thead>
<tr>
<th></th>
<th>Risk</th>
<th>Likelihood</th>
<th>Impact</th>
<th>Action (Response)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Ministry of Education will not approve of the proposed system.</td>
<td>Low</td>
<td>Very High</td>
<td>Maintain engagement of Ministry of Education personnel during all phases of the system planning and development.</td>
</tr>
<tr>
<td>B</td>
<td>The software will not operate as planned.</td>
<td>Low</td>
<td>High</td>
<td>Hire the best available and most experienced software development designers and conduct interim system testing during the development phase.</td>
</tr>
<tr>
<td>C</td>
<td>Failure in the internet connectivity.</td>
<td>Medium</td>
<td>Very High</td>
<td>The risk will be mitigated by conducting wireless internet signal strength testing. The internet provider will be provided test data so they can make their signal more robust where needed.</td>
</tr>
</tbody>
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<th>Action (Response)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>Failure in the Database.</td>
<td>Very Low</td>
<td>Very Low</td>
</tr>
<tr>
<td>E</td>
<td>Difficulty in using the system for new users</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>F</td>
<td>There will be viruses injected by computer hackers</td>
<td>High</td>
<td>Very High</td>
</tr>
<tr>
<td>G</td>
<td>Breakdown in the system</td>
<td>Medium</td>
<td>Very High</td>
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</tbody>
</table>
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<th>Action (Response)</th>
</tr>
</thead>
<tbody>
<tr>
<td>H Integration or Interface risk</td>
<td>Low</td>
<td>High</td>
<td>Conduct testing of hardware components and software modules as they are developed.</td>
</tr>
<tr>
<td>I Unknown risks</td>
<td>Low</td>
<td>Medium</td>
<td>Create management reserve for both schedule and cost accommodation for unknown risks.</td>
</tr>
<tr>
<td>J Implementation risk</td>
<td>Low</td>
<td>Medium</td>
<td>Hire the best available and most experienced software development designers and conduct interim system testing during the development phase.</td>
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</tbody>
</table>
# Risk Assessment

<table>
<thead>
<tr>
<th>Likelihood</th>
<th>Very High</th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
<th>Very Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very High</td>
<td>[F]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td></td>
<td>[E]</td>
<td>[C] &amp; [G]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>[I] &amp; [J]</td>
<td>[B] &amp; [H]</td>
<td></td>
<td>[A]</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very Low</td>
<td>[D]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Before Risk Mitigation*
# Risk Assessment

<table>
<thead>
<tr>
<th>Likelihood</th>
<th>Very Low</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
<th>Very High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very High</td>
<td></td>
<td></td>
<td></td>
<td>[F]</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td></td>
<td>[H]</td>
<td>[B],[E] &amp; [G]</td>
<td>[A] &amp; [I]</td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>[D]</td>
<td>[J]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*After Risk Mitigation*
# Verification and Validation

<table>
<thead>
<tr>
<th>#</th>
<th>System Requirements</th>
<th>Verification Techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The System shall verify on a regular basis responsible user ID and location.</td>
<td><strong>Testing</strong> (Hackers should be hired to look for the weak points in the system)</td>
</tr>
<tr>
<td>2</td>
<td>The system shall offer information about all the schools in Saudi Arabia (the location, the number of students in a school, etc )</td>
<td><strong>Testing</strong> (all schools will be included and verification will be made that the schools data are properly entered into the system)</td>
</tr>
<tr>
<td>3</td>
<td>The system shall provide the Human Resources Department at the Ministry of Education with accurate data about prospective teachers.</td>
<td><strong>Analysis</strong> (compare prospective teachers' data for nomination process)</td>
</tr>
</tbody>
</table>
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</tr>
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<tbody>
<tr>
<td>4</td>
<td>The system shall update the database that houses the schools listing information yearly.</td>
<td><strong>Inspection</strong> (The verification of the schools listings stored (by location and grade levels) will be checked by the Ministry of Education employees.)</td>
</tr>
<tr>
<td>5</td>
<td>The system shall provide software copy of educational curricula.</td>
<td><strong>Demonstration</strong> (software copy of educational curriculums will be available for the students/teachers to access them instead of using a hard copy.)</td>
</tr>
<tr>
<td>6</td>
<td>The system shall provide an online tutorial to allow students to practice.</td>
<td><strong>Demonstration</strong> (conduct a review of online tutorial by the Ministry of Education.)</td>
</tr>
</tbody>
</table>
Systems Architecting Approach

OV-5 (Operational Activity Model)

Ministry of Education (MOE)

- Taking the students & prospective teachers information
- Providing test trade-offs among the applicants for the post of teacher
- Issue a student number (ID)
- Providing video tutorial online curriculum
- Receiving prospective teachers resume
Systems Architecting Approach

OV-5 (Operational Activity Model)

User

Giving their information

School

Sending school’s info to MOE

Implement the ministry instructions
Systems Architecting Approach

SV-1 (System Interface Description)

- Ministry of Education (MOE)
- Computers & Internet
- Servers
- School
- Computers & Internet
Systems Architecting Approach

SV-4 (System Functionality Description)

- Ministry of Education (MOE)
  - The new software - Computers
  - Receiving Data
  - Sending information
  - Saving Data
  - Servers
Systems Architecting Approach

SV-4 (System Functionality Description)

User
- Personal computer
  - Sending information

School
- The new software - Computers
  - Receiving information
  - Sending information
**Systems Architecting Approach**

**Heuristic Approach:**

- **Risks are impossible to detail completely and correctly, but can be controlled by frequent and early numeric feedback and change.**
  
  Analysis and mitigation of risk management were conducted on the system to identify potential problems associated with its implementation. The system will use metrics such as the rate of students failing to check if the system is completing the intended goal.

- **Systems need to be built to tolerate change and expansion beyond current stakeholder needs.**
  
  The proposed system is designed to meet the changing needs of the students and their family. Furthermore, it is important to plan and stay ahead of current stakeholder needs as they change with the times. The Educational Life System is developed to be online and upgradeable.
Ethics

Four Ethical Lenses:

Rights:
The Ministry of Education is committed to ensuring that every student has access to an education and that he/she is never denied this right.

Justice:
Justice is served when the benefits in a society are distributed in accordance with principles that rational persons would accept as consistent with their own interests. The Developing Educational Life System achieves this principle by distributing the benefits that meet the interests of students and their families equally.

Utility:
Parents want their children to develop good characters, appreciate the good life, and be generally civilized human beings. Of course, different parents may want an exquisite educational environment for their children, and school choice would allow them to find the schools that meet their needs and tastes.

Virtue:
Thus, an ethical evaluation of educational services needs to consider the intent of The Ministry of Education and the ways in which a particular campaign is executed such as the use of the slogan: "the student is always the focus of our attention."
Ethics

Procedures to Counter Nepotism:
To ensure fairness and equity, the system promotes equal opportunity in procedures relating to the Ministry of Education including: employment (hiring qualified applicants), transferring students, and quality of education without regard to race.
Conclusion

- Saudi Arabia is still striving to respond to the technological evolution in education. Therefore, there has to be an advanced education system to facilitate the process of collecting the educational records of students, prospective teachers, and schools and providing access to the records when needed.

- There are three proposed solutions that can be applied to the educational system, but based on the measure of effectiveness, alternative two is selected. This alternative is developing educational life system, and is the best option to implement.

- Alternative one is less desirable than the second alternative. The developing educational life system will collect the educational records of students, prospective teachers, and schools around the country.
Lessons Learned from the System Engineering Studies

1. It is necessary to understand and manage requirements in order to solve complex problems.

2. It is imperative to identify all risks early, to allow the system to be built in a way that reduces potential threats to the integrity of the system.

3. Regular software maintenance must be performed by highly skilled developers.

4. Deciding which is the best system to resolve the problem considering all sides requires analysis of the proposed alternatives.
References


References


