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Software Quality Assurance Using Agile Software Methodology in Education Assessment Industry

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**Software Quality Assurance Using Agile Software Methodology
in Education Assessment Industry**

by

Barkha Rajput

A Starred Paper

Submitted to the Graduate Faculty of

St. Cloud State University

in Partial Fulfillment of the Requirements

for the Degree

Masters of Engineering Management

August, 2016

Starred Paper Committee:
Hiral Shah, Chairperson
Ben Baliga
Balasubramanian Kasi

Abstract

Contradictory directive between federal and state along with expensive investments in assessment strategies that may no longer work with new standards were just a few issues making educational assessment increasingly complicated. With evolution of rapid changing environment following student assessment practice, policy and analysis can be tough.

This capstone project helped to build reliable and quality online solution which assisted to guard against system failures and scoring errors, and hold itself accountable for the security of the assessment process with use of cutting edge technology such as Agile in which incremental and iterative development of product through various cycles or feedback with involvement of cross functional and self-managing team helps to achieve product improvement.

Acknowledgements

I wish to express my deep sense of respect, and indebtedness to my advisor, Dr. Hiral Shah, for her valuable suggestions, and ceaseless inspiration during the project work

I would also like to thank Dr. Ben Baliga and Dr. Blasy Kasi, without their support, encouragement, and guidance this project would not have been a reality.

Last but not least, I would like to thank my husband Mahendra, my kids, my caring parents, and my friends for their inspiration, encouragements, everlasting blessing, and abundant love for me for the successful completion of this achievement.

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Chapter I: Introduction

Introduction

A company based in Minnesota is the innovative large scale assessment solution provider company. It had successfully implemented more than 100 large-scale assessment programs across different states. It grew nearly in the 40 years of business by encompassing new professional services model to deliver a superior customer experience, rework the online testing platform to include more student accommodations and achieve fairer testing for all. Attention to the smallest details yields incrementally better processes, products and programs—and more satisfied customers at every level. It specializes in researching, designing and managing innovative assessment programs for reading, mathematics, science from Kindergarten to high school graduation programs in both paper-and pencil and online formats. It offers a comprehensive evaluation of English-language proficiency for English language learners who are non-native speakers of English.

This project was carried out to design and manage innovative assessment programs for state and local education agencies and to impart teachers with good tools and information to better serve the students in education system.

Problem Statement

There was a need of reliable and quality online solution that not only provide standardized student testing but also flexible enough to offer paper/pencil and online assessments, with data analysis and reporting of student results, which

provide both accountability and learning through actionable data to the state staff, districts and classroom teachers.

Nature and Significance of the Problem

A lot of pressure was placed on students and educational entities to meet standards of proficiency. Students must pass high-stakes tests to graduate from high school. Schools must meet a level of proficiency to keep their standing within the community and state, as well as maintain steady levels of funding.

With the implemented Qualitative assessment project, state must able show that their students, through their schools, are meeting proficiency standards to qualify for funding from the federal government.

Objective of the Project

The objective of project was to build a Qualitative assessment solution that provides assessment design, computerized/ human scoring service, online report and visualization features by using project management techniques.

Project Questions

Following questions were answered with the successful implementation of this project:

1. What were the main problem of the current assessment system and how this project overcame these problems?
2. What were the merits of agile methodology in rapid changing environment compared to waterfall methodology which helped QA process to improve?

3. What were the key benefits achieved after project was implemented successfully?
4. What were the defect count completed during various sprints which helped project team to improve overall project timeline, performance and projection?

Limitations of the Project

This project helped to improve QA process in numerous way but Agile methodology has some limitation such heavy customer interaction mandatory, co-located agile team, difficulty scaling for large project, lacks attention to outside organization.

Definition of Terms

Following is the list of term used in this report.

- ✓ Test Case: Set of conditions under which a tester determine whether an application, software system or one of its features was working as it was originally established for it to do.
- ✓ RTM: Requirement Traceability Matrix is a document that links requirements throughout the validation process. The purpose of the Requirements Traceability Matrix is to ensure that all requirements defined for a system are tested in the test protocols.
- ✓ SQL: Structured Query Language is used to communicate with a database.
- ✓ ELA: English Language Arts
- ✓ QA: Quality Assurance

- ✓ SCRUM: It is an iterative and incremental agile software development framework for managing product development.
- ✓ SPRINT: It is a set period of time during which specific work has to be completed and made ready for review.

Summary

This chapter was mainly focused on the problem statement, Nature and significance of the problem and the objective of the project. In this chapter the need of quality online assessment solution is discussed, which not only flexible for students and teachers but also provide result oriented data to get funding. Background related to the problem, literature related to the problem and methodology used for implementing the project will be discussed in the next chapter.

Chapter II: Background and Review of Literature

Introduction

This chapter clearly describes about the background related to the problem in detail and also provides the literature related to the problem so that this literature can be used for further analysis in future to gain more knowledge over the problem. This chapter also explains about the literature related to the methodology of the problem.

Background Related to the Problem

Software Applications are essential tools that play a very important role in charting the success story of any business. A well planned and clearly defined software quality process application lays the foundation for better product. Today, continuous change are required to match with the ever changing demands of the customer. To achieve this, very highly efficient applications were used by business to cater its needs. In this project, the main focus was to improve quality of an existing application which eventually reduced the time, effort and errors that were put into the application. After an exhaustive analysis of the existing methodologies, traditional waterfall model was shortlisted because of its rigidity and easy to use characteristics.

Literature Related to the Problem

Quality is an integral part of assessment industry. But with the need of continuous change in requirement company faces hard time to manage to quality of assessment solution with in given cost and time. After an analysis of the existing methodologies, traditional waterfall model was shortlisted because of its rigidity and easy to use characteristics.

Literature Related to the Methodology

Agile methodology. To help businesses respond to unpredictability, agile approaches are typically used in software development (Waters, 2007). It is iterative and incremental development in which requirements and solutions evolve through collaboration between self-organizing, cross-functional teams. Figure 1 shows agile software development promotes adaptive planning, evolutionary development and delivery, a time-boxed iterative approach, and encourages rapid and flexible response to change. Due to its simplicity and flexibility “Scrum” became the most popular way of introducing Agility. Scrum emphasizes empirical feedback, team self-management, and striving to build properly tested product increments within short iterations.

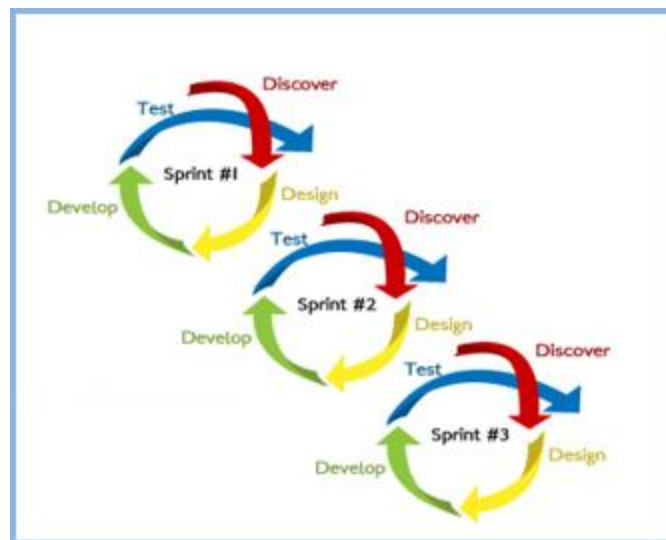


Figure 1. Typical agile cycle (CommonPlaces, 2012).

Agile scrum methodology. SCRUM is an agile development method which concentrates specifically on how to manage tasks within a team based development environment. As shown in Figure 2, a product owner creates a prioritized wish list

called a product backlog. During sprint planning, the team pulls a small chunk from the top of that wish list, a sprint backlog, and decides how to implement those pieces. The team has a certain amount of time—a sprint (usually 2 to 4 weeks)—to complete its work, but it meets each day to assess its progress (daily Scrum). The sprint ends with a sprint review and retrospective (Scrumalliance, 2016).

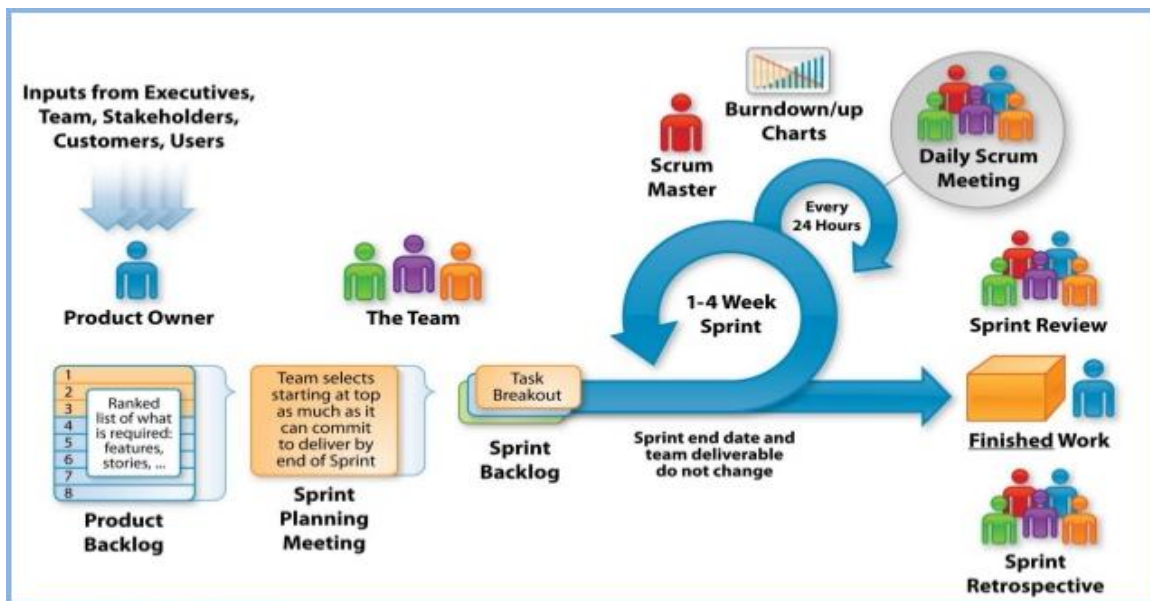


Figure 2. Agile: Scrum framework (C# Corner, 2015).

Basically, Scrum is derived from activity that occurs during a rugby match. Scrum believes in empowering the development team and advocates working in small teams (say—7 to 9 members). It consists of three roles, and their responsibilities are explained as follows:

- Scrum Master
 - Master is responsible for setting up the team, sprint meeting and removes obstacles to progress
- Product owner
 - The Product Owner creates product backlog, prioritizes the backlog and is responsible for the delivery of the functionality at each iteration

- Scrum Team
 - Team manages its own work and organizes the work to complete the sprint or cycle. (Guru⁹⁹, 2016)

Product backlog. This is a repository where requirements are tracked with details on the no of requirements to be completed for each release. As shown in Figure 3, it should be maintained and prioritized by product owner, and it should be distributed to the scrum team. Team can also request for a new requirement addition or modification or deletion.

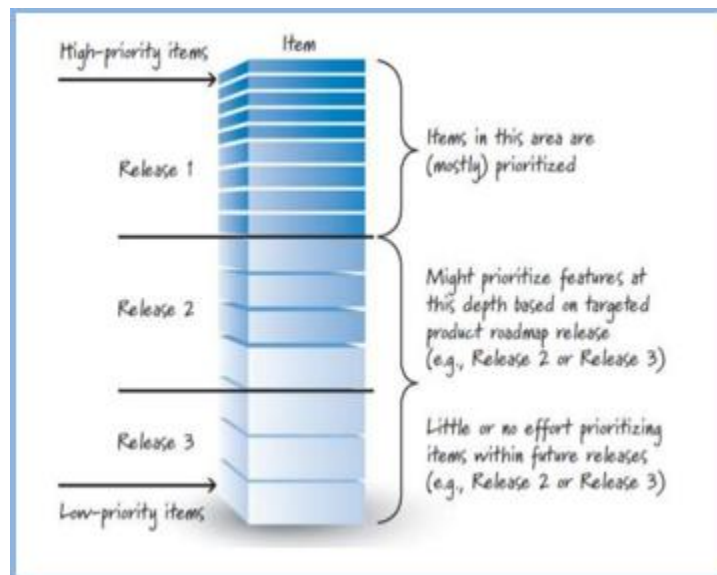


Figure 3. Product backlog item priority (Agile Lucero, 2014).

JIRA. JIRA is a proprietary issue tracking product, developed by Atlassian (2016). It provides bug tracking, issue tracking, and project management functions. Although normally styled JIRA, the product name is not an acronym, but a truncation of Gojira, the Japanese name for Godzilla. It has been developed since 2002.

JIRA Software gives your team the flexibility to plan and adopt any agile practice, whether it be scrum, kanban, or a mixed methodology. Teams can create and estimate stories, build a sprint backlog, visualize activity, measure team velocity, and report on progress (JIRA Software, 2016).

Working with issue. An issue typically represents a user story in JIRA. User can perform the following actions:

- ✓ Creating an Issue
- ✓ Editing an Issue
- ✓ Estimating an Issue
- ✓ Flagging an Issue
- ✓ Ranking an Issue
- ✓ Transitioning an Issue
- ✓ Viewing an Issue

Story workflow. When a new functionality is needed in the system or some changes required for existing functionality user needs to create a new story. As show in Figure 4, story follow the flow mentioned in the figure.

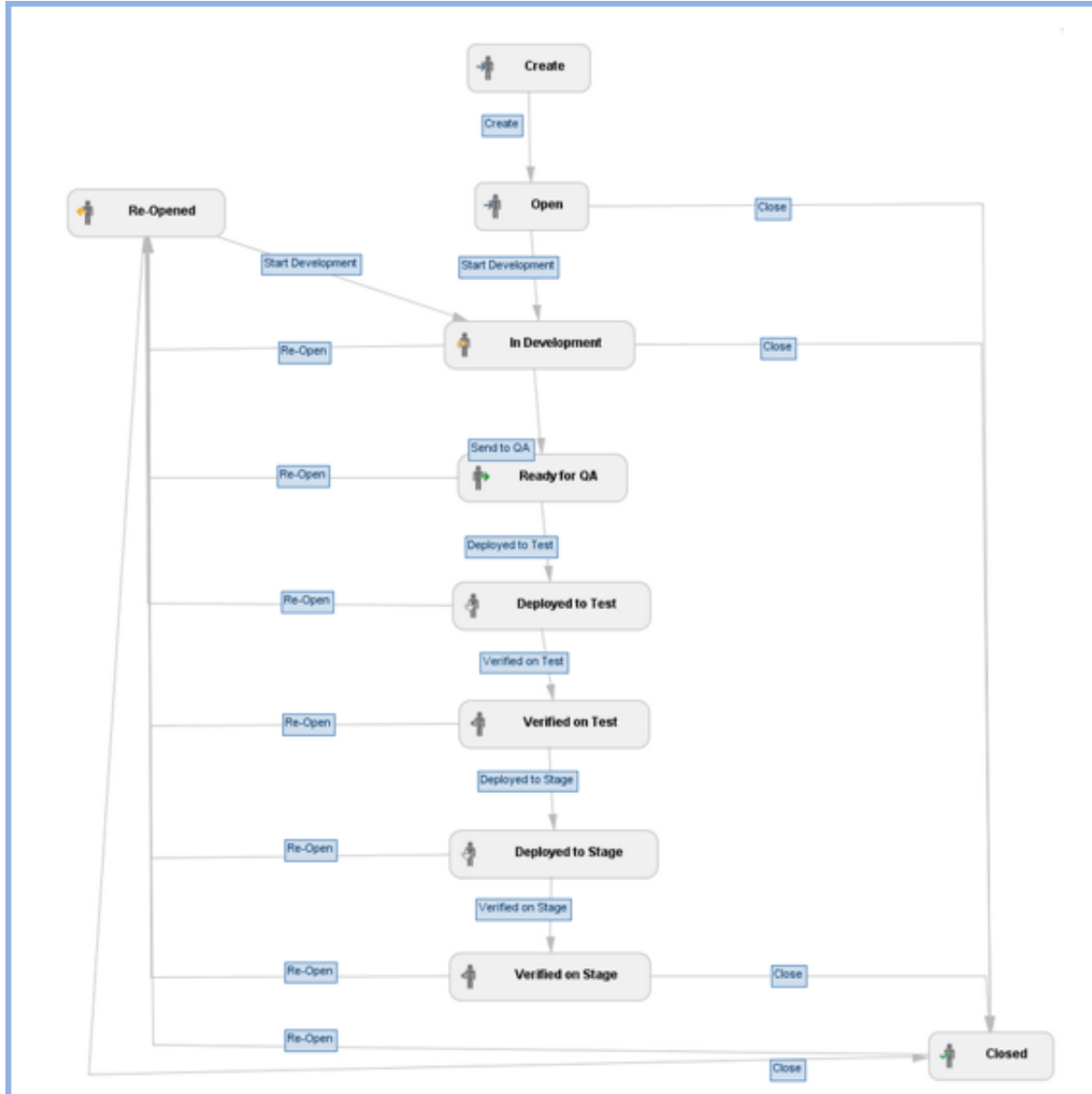


Figure 4. Story workflow (Atlassian Answers, 2014).

Summary

This chapter briefly covers the background and literature of the problem. It also described the methodology used and explained different phases of the agile process. Next chapter discuss about the QA assessment process with the use of tools like JIRA.

Chapter III: Methodology

Introduction

This chapter provides a detailed description of the methodology used for the study such as how QA process works in assessment industry by using agile software techniques.

Design of the Study

In the process of attaining the objectives, the following process shown in Figure 5, was helpful.

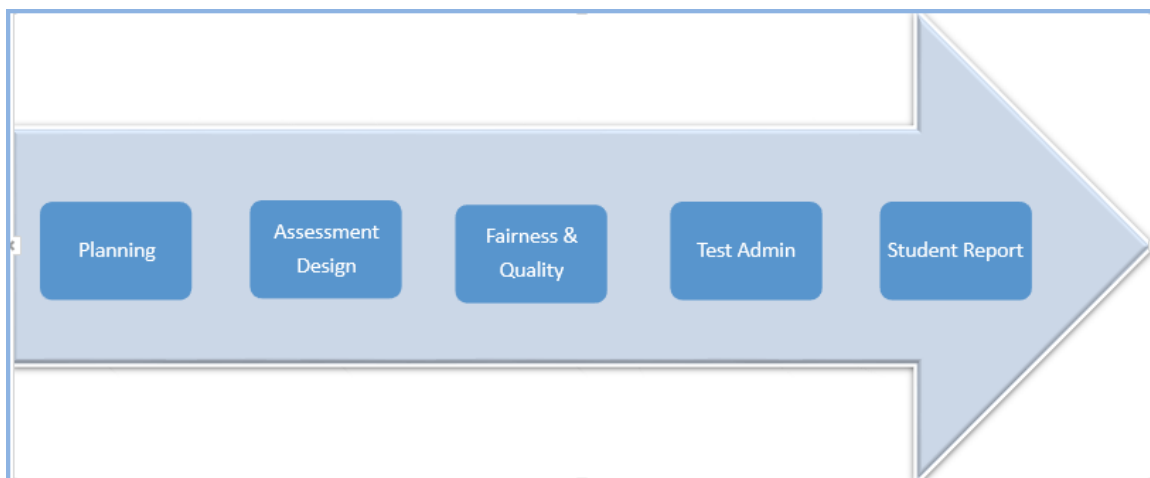


Figure 5. Assessment process.

Assessment process. As shown in Figure 5, there were five phases to manage and built the assessment.

- **Planning:** In planning phase business requirements were set scope of the project is defined. Project manager establishes a communication plan among different teams.

- **Assessment Design:** Materials and items were developed for ELA, Math, Science and Social science for both online and paper pencil tests with the help of Psychometrician.
- **Fairness and Quality:** It ensures that assessments meets standards of American Education Research Association.
- **Test administration:** It provides end to end administration for student /teacher portal with admin portal.
- **Student Report:** Deep expertise with data analysis and reporting of students result.

QA process. Assessment QA Process needs to test the functionality of the Student Tests. It validated that a user can successfully take the assessments with necessary tools and accommodations across all supported devices. The entire QA process ensures the application met the functional, technical and quality requirements for the end users.

As shown in Figure 6, manual tester performed following steps for manual testing:

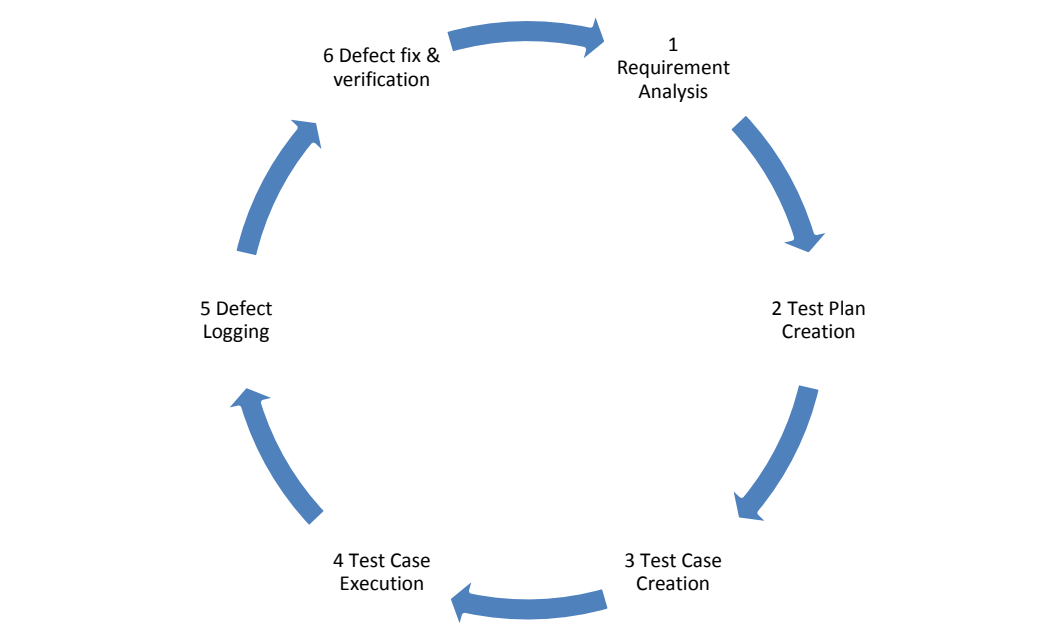


Figure 6. QA process.

- Requirement Analysis: Reviewed Functional Specification and business requirement provided by the business analyst.
- Test plan creation: Designed a QA Plan, test approach which encompasses how the project will be managed, developed, and deployed in a sound, reasonable way gathering previous experience from other projects. Making sure the project's deliverables were of acceptable quality before they were delivered to the project's clients.
- Test case creation-The test case suits created to test the correct behavior/functionality, features of an application. Table 1 displays test case creation template. Requirement traceability matrix (RTM) helped the QA team to identify test scope of project, track the link between the requirement and the testing.

Table 1

Test Case Creation

ID	Priority	Title	OS-Status
001	Critical	Attempt to log in with valid credentials	Not executed
002	Critical	Attempt to log in with invalid credentials	Not executed
003	High	Verify Student information in the field is correct	Not executed
004	High	verify direction page/Instruction sheet	Not executed
005	High	Verify the buttons are left aligned	Not executed
006	Medium	Verify the selector tool marks an answer	Not executed
007	Critical	Verify that highlighter tool highlights an answer	Not executed
008	Medium	Verify the page zoom tool is in the top right corner of the assessment area	Not executed
009	Low	Verify the page zoom tools is set to 100% by default	Not executed
010	Low	Verify the user can Submit a test	Not executed

Test case Execution: In order to execute QA Testing, QA environment was set and loaded according to program specification into QA specifications (Guru⁹⁹, March 2016). Table 2 displays typical test case execution scenario.

Table 2

Test Case Execution

ID	Priority	Story ID	Feature / Requirement	Title	Steps to execute	Expected Result	OS - Status
001	Critical		Login page	Attempt to log in with valid credentials	1. Open the Test Page	The page is loaded	Pass
	Critical		Login page		2. Enter valid user ID in "User ID" field	The data is entered successfully	Pass
	Critical		Login page		3. Enter valid password in "Password" field	The data is entered successfully	Pass
	Critical	Jira-100	Login page		4. Click on the "Sign In" button	User is successfully logged in and sent to user verifying screen page	Fail
003	High	Jira-101	Login page	Attempt to log in with invalid user ID	1. Open the Test Page	The page is loaded	Pass
	High		Login page		2. Enter invalid user ID in "User ID" field	The data is entered successfully	Pass
	High		Login page		3. Enter valid password in "Password" field	The data is entered successfully	Pass
	High	Jira-101	Login page		4. Click on the "Sign In" button	Error message appears: "We couldn't verify your User ID or Password. Please check them and try again."	Fail
007	Medium	Jira-102	Tools	Verify that highlighter tool highlights an answer	3. Select the Highlighter from Tools r	The highlighter icon is colored in blue	Fail
	Medium		Tools		4. Highlight an answer	The answer is highlighted in yellow	Not Executed

Test platform. The test platform was designed to provide state level customers a full-service assessment solution that is reliable and easy-to-use.

1. Online Administrative System–Various users according to their roles can access main page. There were various Tabs on main page such as Home, student, class, test administration, reports and help. QA needs to test the functionality of each tab as shown in Figure 7.

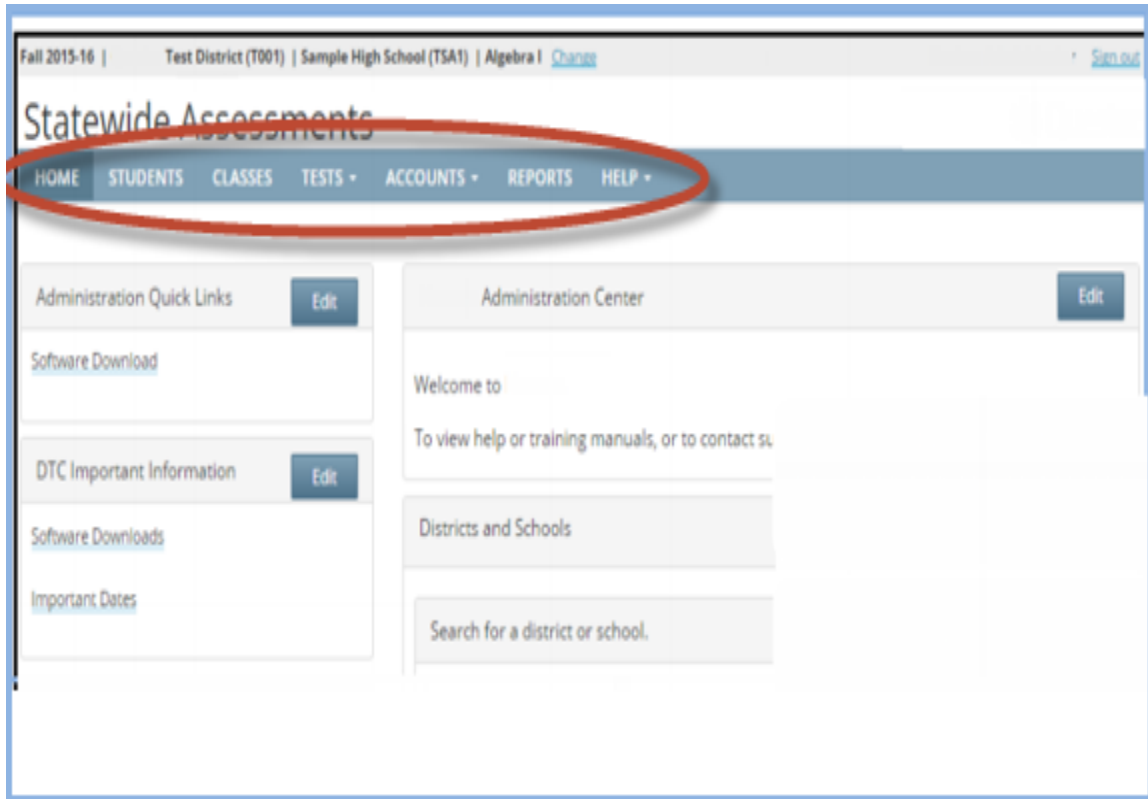


Figure 7. Main page.

Table 3 shows the functionality of various tabs.

Table 3

Main Page with All Functionality

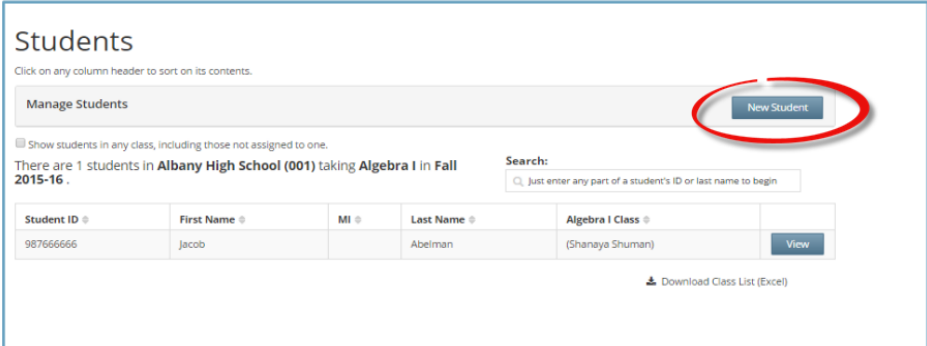
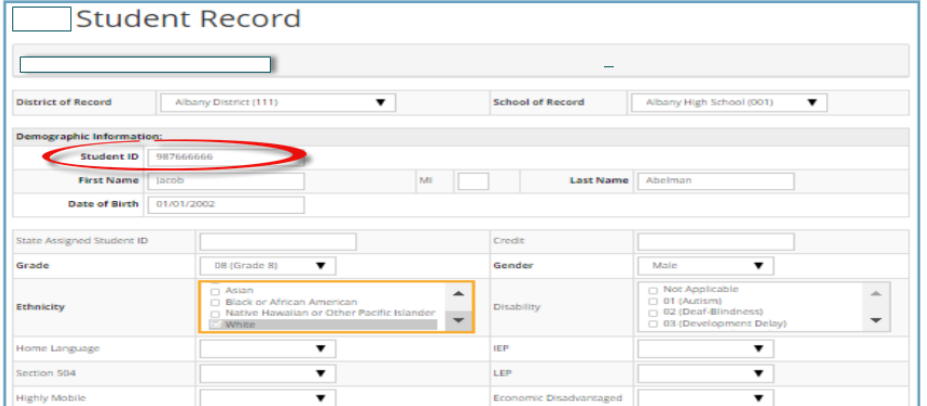
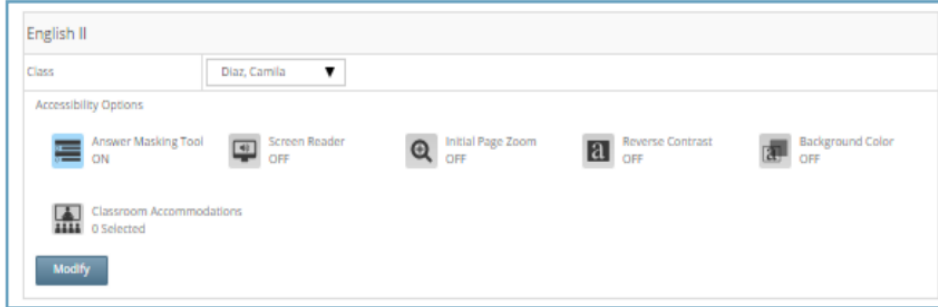
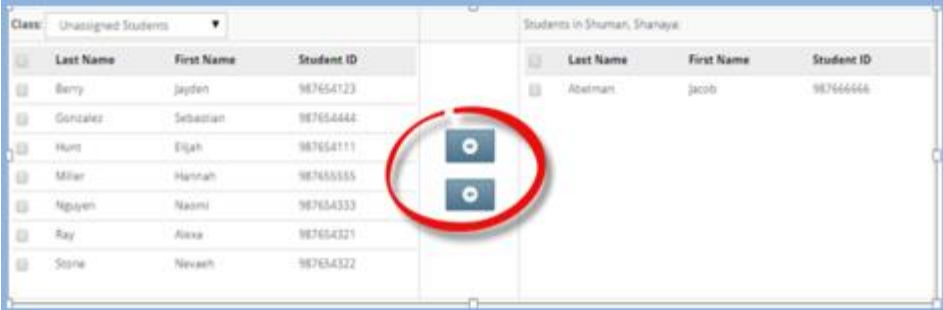
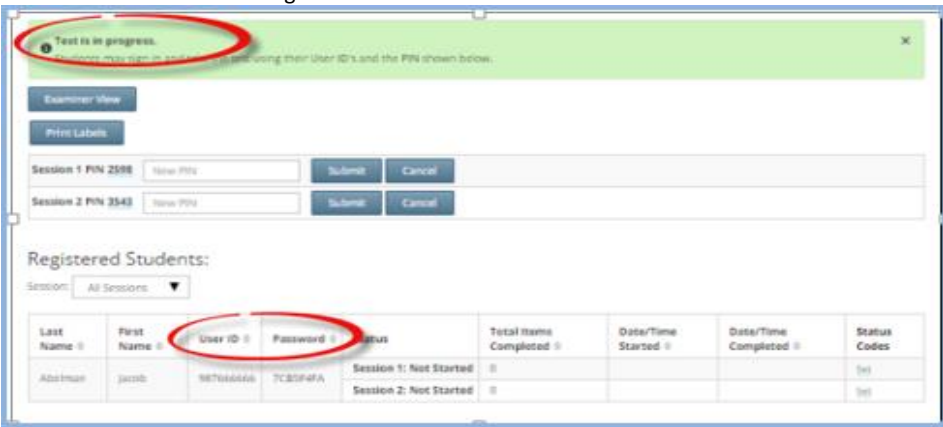
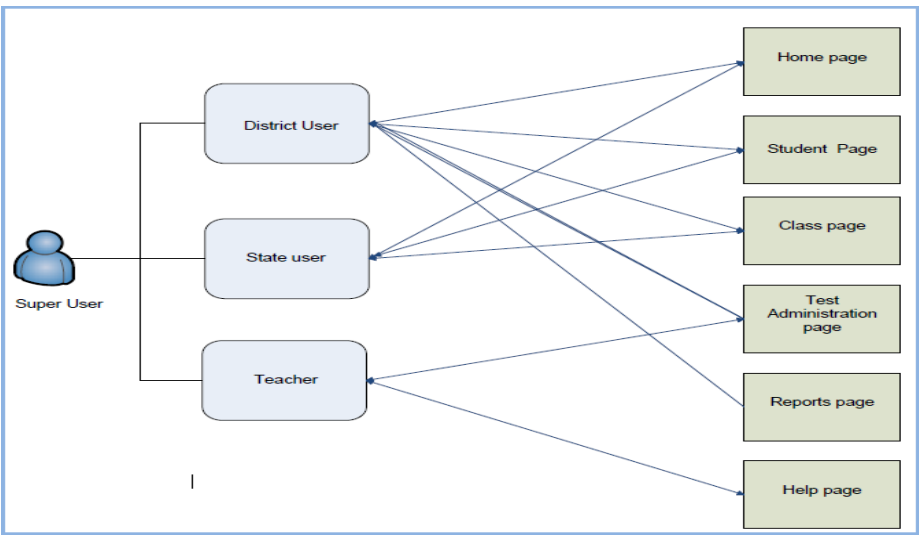
Home :	Home page would be accessible to all users, district level, state level, teachers, parents etc.
Student:	<p>Students can be set individually or in bulk through student tab. Below page displays when user clicks on Student tab. It contains Student information such as student id, student name and class to which student belongs. User also can add new student by clicking New Student button</p> 
New Student:	<p>User can add new student by entering all the demographic information such as student ID, student first and last name, grade, ethnicity, gender and class to which student belongs. Student ID should be a unique field for every student</p> 
Student Accommodation:	<p>Student needs and preferences can also be set through student page. super user can select and set the accommodation according to specific parameters</p> 

Table 3 (continued)

<p>Classes:</p>	<p>Super User can create a new class, provide a name. Add students to class. Move students in and out of class.</p> 																											
<p>Test Administration</p>	<p>Selecting test administration drop down menu super user can print labels which contains information about student logins which student needs to access the tests.</p>  <table border="1" data-bbox="451 1066 1349 1161"> <thead> <tr> <th>Last Name</th> <th>First Name</th> <th>User ID</th> <th>Password</th> <th>Status</th> <th>Total Items Completed</th> <th>Date/Time Started</th> <th>Date/Time Completed</th> <th>Status Codes</th> </tr> </thead> <tbody> <tr> <td>Abelman</td> <td>Jacob</td> <td>987654321</td> <td>TC20F4FA</td> <td>Session 1: Not Started</td> <td></td> <td></td> <td></td> <td>Yes</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>Session 2: Not Started</td> <td></td> <td></td> <td></td> <td>Yes</td> </tr> </tbody> </table>	Last Name	First Name	User ID	Password	Status	Total Items Completed	Date/Time Started	Date/Time Completed	Status Codes	Abelman	Jacob	987654321	TC20F4FA	Session 1: Not Started				Yes					Session 2: Not Started				Yes
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				Session 2: Not Started				Yes																				
<p>User Role</p>	<p>Below figure shows super user's role access details.</p>  <pre> graph LR SU[Super User] --> DU[District User] SU --> SUr[State user] SU --> T[Teacher] DU --> HP[Home page] DU --> SP[Student Page] DU --> CP[Class page] DU --> TAP[Test Administration page] DU --> RP[Reports page] DU --> HP2[Help page] SUr --> HP SUr --> SP SUr --> CP SUr --> TAP SUr --> RP SUr --> HP2 T --> HP T --> SP T --> CP T --> TAP T --> RP T --> HP2 </pre>																											

2. Secure Testing of Tests–Secure browser keeps students focused on their test with no distractions and keeps the test secure. QA needs to follow step by step process to test the student's test. The example of steps are mentioned below:

- ✓ Launch secure browser (Secure browser can be downloaded from Help Tab on Home page).
- ✓ Login as student by using username/password.
- ✓ Verify student information.
- ✓ Select the first test session.
- ✓ Directions / instructions are available.
- ✓ Enter session login/password.
- ✓ Begin the test.
- ✓ Validate the functionality of every tool as show in Figure 8 on Tests.

The available tools on test are Highlighter, ruler, Reading Guide, Protractor, Calculator, notepad, Zoom, flag.

The screenshot shows a math test interface for "Math - Grade 8". The question is "Question 17 of 33" and indicates that 0 of 33 questions have been answered. The question text is:

Function 1 is represented by the equation $5y - 3x = 25$.

Function 2 is represented by the table.

X	Y
5	31
10	37
15	43
20	49

Below the table is a ruler labeled "INCHES" with markings from 1 to 5. To the right of the ruler is a calculator window titled "Calculator" with a numeric keypad and function buttons.

The question asks: "Which statement about the two functions is true?"

Three options are listed:

- (A) The rate of change for Function 2 is half the rate of change for Function 1.
- (B) The rate of change for Function 2 is twice the rate of change for Function 1.
- (C) The rate of change for Function 2 is 5 times the rate of change for Function 1.

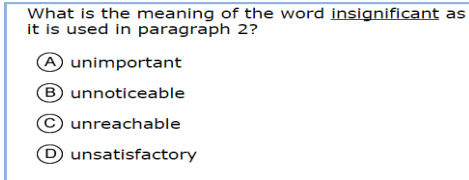
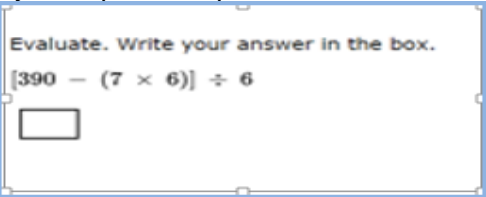
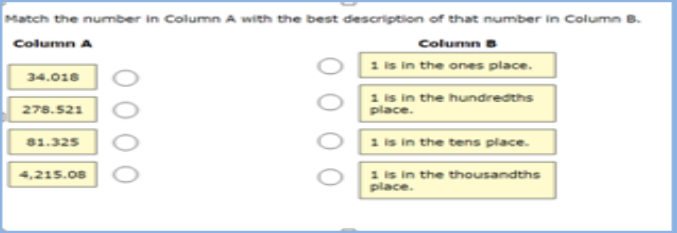
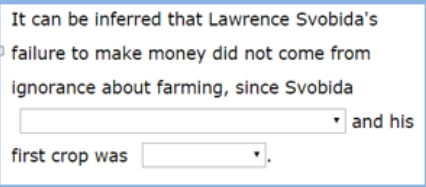
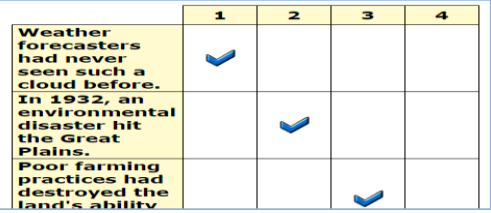
Options (B) and (C) are highlighted in yellow in the original image.

Figure 8. Tool functionality.

- ✓ Tests supports a full set of item as shown in Table 4.

Table 4

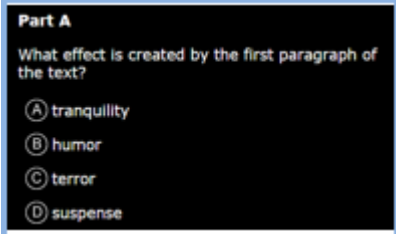
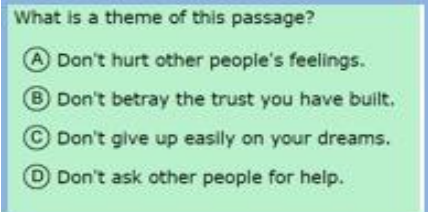

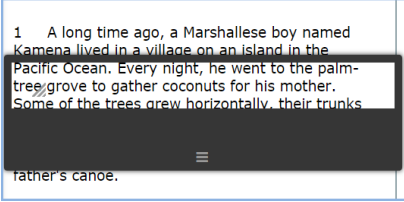
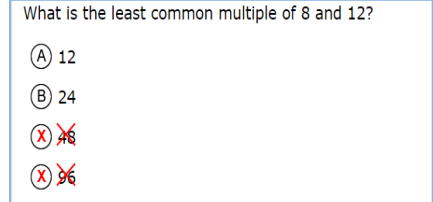
Test Question Types

Multiple Choice Item	<p>A multiple choice question where the student clicks on the letter or the answer string itself to indicate their answer.</p> 																				
Text Type:	<p>Text type is a constructed response item with a text box try to capture response.</p> 																				
Match Type Items:	<p>The student drags from the left circle to the desired right circle to initiate the match. There can be only one line drawn for one match answer.</p> 																				
Dropdown Items	<p>Drops down items simply provide options to select answer from several choices from dropdown.</p> 																				
Multi- select Table:	<p>Student indicate their answer by clicking on open cell.</p>  <table border="1" data-bbox="574 1583 1062 1793"> <thead> <tr> <th></th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>Weather forecasters had never seen such a cloud before.</td> <td style="text-align: center;">✓</td> <td></td> <td></td> <td></td> </tr> <tr> <td>In 1932, an environmental disaster hit the Great Plains.</td> <td></td> <td style="text-align: center;">✓</td> <td></td> <td></td> </tr> <tr> <td>Poor farming practices had destroyed the land's ability</td> <td></td> <td></td> <td style="text-align: center;">✓</td> <td></td> </tr> </tbody> </table>		1	2	3	4	Weather forecasters had never seen such a cloud before.	✓				In 1932, an environmental disaster hit the Great Plains.		✓			Poor farming practices had destroyed the land's ability			✓	
	1	2	3	4																	
Weather forecasters had never seen such a cloud before.	✓																				
In 1932, an environmental disaster hit the Great Plains.		✓																			
Poor farming practices had destroyed the land's ability			✓																		

- ✓ Select the answer options, pause and sign out.
- ✓ Response validation: QA needs to validate the responses are restored on the test.
- ✓ Validate various accommodations set for student testing, The various accommodation for student testing are shown in Table 5.

Table 5

Accommodation Types

Reverse Contrast	Reverse contrast shows white text on black background. 
Background Color	Background color with Blue, Green having Black text. 
Answer Masking	The answer options are masked. The user needs to select a green icon in order to unmask the answer options. 
Reading Guide	Reading guide helps the user to read text in a given box. 
Answer eliminator:	Answer option can be eliminated by the use of answer eliminator. 

- A **defect** is a product anomaly or flaw, which is variance from desired product specification. **Severity** is a fundamental measure of a defect / bug.

Table 6 shows the definition of severity metrics and ranking criteria used to define them.

Table 6

Defect Severity Ranking

Severity Ranking	Ranking Criteria
Severity 1	Program ceases meaningful operation
Severity 2	Severe function error but system can continue
Severity 3	Unexpected result or inconsistent operation
Severity 4	Design or suggestion

(Hutcheson, 2003)

Severity is also denoted as below:

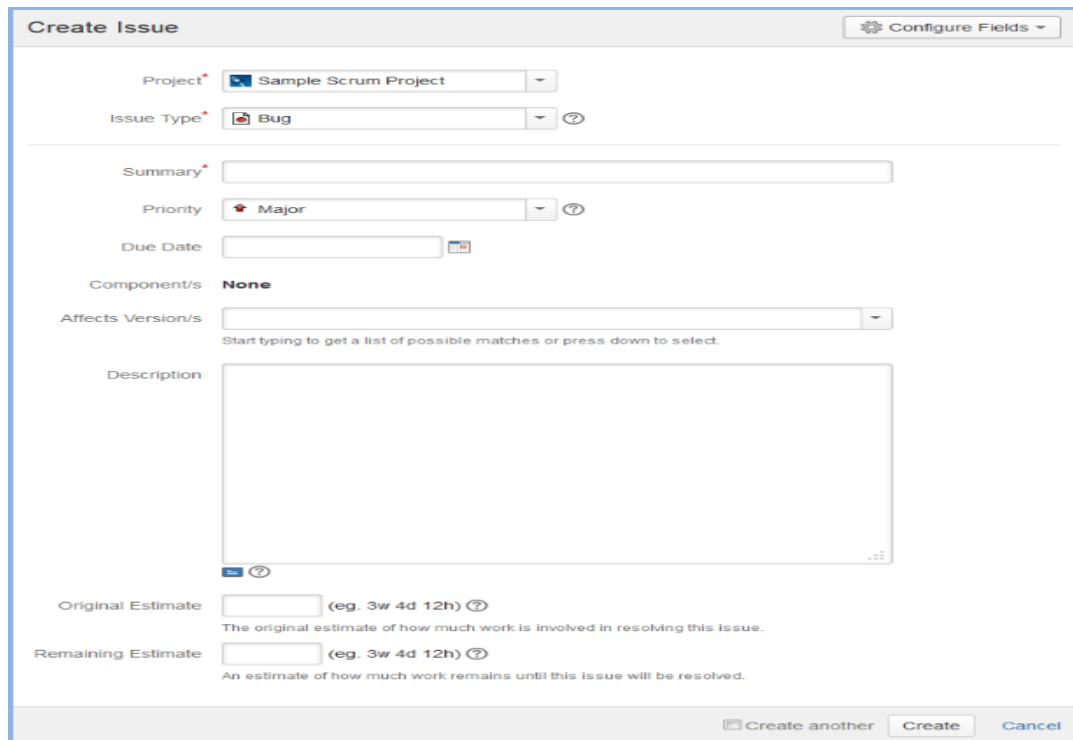
- S1 = Critical
- S2 = Major
- S3 = Minor
- S4 = Trivial

The Defect tracking and management is a fundamental and critical part of QA.

The defects should be tracked from beginning to closure in entire Product. JIRA is a software tool developed by Atlassian, commonly used for bug tracking, project management and issue tracking of entire project.

Below steps describes how issue can be created in JIRA.

- ✓ Creating an Issue: Click create at the top of the screen in JIRA to open the create issue dialog box as shown in Figure 9.



The screenshot shows the 'Create Issue' dialog box in JIRA. The form is titled 'Create Issue' and has a 'Configure Fields' button in the top right corner. The fields are as follows:

- Project:** Sample Scrum Project (dropdown)
- Issue Type:** Bug (dropdown with a bug icon and a help icon)
- Summary:** (text input field)
- Priority:** Major (dropdown with a help icon)
- Due Date:** (calendar icon)
- Component/s:** None
- Affects Version/s:** (dropdown with a help icon and a note: 'Start typing to get a list of possible matches or press down to select.')
- Description:** (text area with a help icon)
- Original Estimate:** (text input field with a help icon and example: '(eg. 3w 4d 12h)')
The original estimate of how much work is involved in resolving this issue.
- Remaining Estimate:** (text input field with a help icon and example: '(eg. 3w 4d 12h)')
An estimate of how much work remains until this issue will be resolved.

At the bottom right, there are three buttons: 'Create another', 'Create' (highlighted), and 'Cancel'.

Figure 9. JIRA—create issue (Atlassian Documentation, JIRA Agile 6.7, 2016)

- ✓ Table 7 display various details to be filled in create issue screen.

Table 7

JIRA–Create Issue Field

Project:	A JIRA project is a collection of issues, and is defined according to your Organization's requirements. For example, xyz Statewide Assessments.
Issue type:	JIRA can be used to track many different types of issues. The default types are listed below: Bug: A problem which impairs or prevents the functions of the product. Improvement: An enhancement to an existing feature. New Feature: A new feature of the product. Task: A task that needs to be done. Custom Issue: A custom issue type, as defined by your organization if required.
Summary:	A brief description about an issue.
Priority:	The importance of the issue in relation to other issues. Highest: Indicates this problem will block progress. High: Indicates that this issue is causing a problem and requires urgent attention. Medium: Indicates that this issue has a significant impact.
Assignee :	The person to whom the issue is currently assigned.
Environment :	The hardware or software environment to which the issue relates.
Status:	The stage the issue is currently at in its lifecycle (workflow).
	Open: This issue is in the initial 'Open' state, ready for the assignee to start work on it.
	In Progress: This issue is being actively worked on at the Moment by the assignee.
	Resolved —A Resolution has been identified or implemented, and this issue is awaiting verification by the reporter. From here, issues are either 'Reopened' or are 'Closed'.
	Reopened : This issue was once 'Resolved' or 'Closed', but is now being re-examined
	Closed: This issue is complete.
	Awaiting QA Deployment: Design and code review is done and issue is ready for QA deployment.
	In QA Testing – The item is ready for regression and automation testing. If the tester have question during the status, then it will move in to “need clarification” and add their comments to the ticket with appropriate resource tagged.
	If defects are found, the QA perform the following task item is transition back in 'development'
	Tester creates a bug in JIRA and relate them to original work item where defect was discovered. (Atlassian JIRA)
Attachment:	User can attach screenshot or image.
Commenting:	Adding comments to an issue is a useful way to record additional detail about an issue, and collaborate with team members\
Sub Tasks:	A sub-task can be created for an issue to either split the issue into smaller chunks, or to allow various aspects of an issue to be assigned to different people.

- Once the test case are entered, responses are Scored by machine and humans depending on type of question. QA need to validate that the response are accurately stored in database. The data validation needs to verify the raw score generated should match with expected scores. Reports needs to generated and verified in QA environment once the scoring is done.

Data Collection

Following process followed for data.

- ✓ The business team gets file from state having respective information about student and teacher.
- ✓ QA team load this file date in SQL database in below format and validate as shown in Figure 10.

S.IN	Firstname	Lastname	D.O.B	Gender	Grade	TeacherNumber	Subject	SchoolName	SchoolNumber	ClassName
100000011	Terrica	Shawn	2/2/2008	F	3	565	English	ABC Elementary School	565	English Class
100000012	Nick	Robert	2/12/2006	M	5	565	English	ABC Elementary School	565	English Class
100000013	Carol	Teff	11/10/2006	F	5	565	English	ABC Elementary School	565	English Class
100000014	Jim	Smith	1/10/2005	M	6	565	English	ABC Elementary School	565	English Class
100000014	Linda	Jones	9/9/2006	F	5	565	English	ABC Elementary School	565	English Class
100000016	Cathy	Taylor	3/3/2004	F	8	878	Mathematics	STAR Elementary School	878	Mathematics Class
100000017	Jhon	Lopez	6/6/2008	M	3	878	Mathematics	STAR Elementary School	878	Mathematics Class
100000018	Luke	Clark	7/21/2004	M	8	878	Mathematics	STAR Elementary School	878	Mathematics Class
100000019	Ellily	Edwards	4/17/2003	F	9	878	Mathematics	STAR Elementary School	878	Mathematics Class
100000020	Nancy	Collins	3/15/2002	F	10	878	Mathematics	STAR Elementary School	878	Mathematics Class

TeacherNumber	TeacherFirstName	TeacherLastName	ClassName	Subject	SchoolNumber
5645486	John	Thomas	English Class	English	565
4654376	Jesse	Jones	Mathematics Class	Mathematics	878

Figure 10. Sample of student file provided by state.

Data Analysis

Here we used JIRA to manage sprint dashboard, product backlog and burn down chart. We will discuss this in next chapter.

Budget

The entire project was completed within the cost provided by the client. No extra costs were incurred during the development of this project.

Timeline

Table 8 display the timeline followed in this project.

Table 8

Project Timeline

Activity	Timeline	Comments
Inception	February 2016	Successfully Completed
Requirement Analysis	March 2016	Successfully Completed
Technical Specification	April 2016	Successfully Completed
Initial Roll Out	April 2016 – May 2016	Successfully Completed
Implementation	June 2016	Successfully Completed
Final Defense Presentation	July 2016	Current Phase

Summary

In this chapter we discussed assessment process, QA process, steps to create issue in JIRA, process to be followed for data collection and techniques used in data analysis, along with timeline of project. Next chapter discuss about the students data collection with analysis details.

Chapter IV: Data Presentation and Analysis

Introduction

This chapter provide reports details along with analysis of sourced data.

Data Presentation

The student reporting is a critical part of the assessment workflow. There is a reporting component in every product in the portfolio. Output created for reporting included data files and reports. QA validated all the data that's goes into a report. Report presentation needs to be validated making sure the entire report follows a standardized format.

One part of the reporting Matrix is the types of reports.

School summary report. This report contains all Student test results in a public district/school. The report includes the scored results for all subjects ELA, Mathematics, Science, Social studies. The reports shows no of student tested in different school along with their mean student score and proficiency rating. Sample of School report is shown in Figure 11.

snag

Logo:		Subject:						
				School Report				
Updated mm/dd/yyyy								
	# of Students		Proficiency Rating	Cellular Chemistry and Structure	Matter Cycles, Energy Transfer, and Interdependence		Cellular Reproduction	Evolution
Student Score Range			% Passing	51	60		43	90
School: Sample High School (9999)			0%	0%	0%		67%	0%
School: Sample Pine High School (9993)	1,084		80%	86%	91%		84%	36%
Summary	1,084		80%	86%	91%		84%	36%
2013-14 SUMMARY	100,000		85%	85%	85%		85%	85%

Figure 11. School report.

Class report. This report contains list of Student tested in a particular class. As shown in Figure 12, the report includes the scored results for all subjects ELA, Mathematics, Science, Social science. The reports shows no of student tested in a class along with their mean student score and proficiency rating. It presents information about students who are appearing first time for test against the re-testers.

Logo:		Subject:			
Class Report					
Teacher: SAMPLE, MARY Class: 102		School: Sample High School (9999)			
Number of Students Tested in Class = 4		Number of Students with Completed Tests in Class = 3			
Student Name	Student Score	Proficiency	Reading Comprehension	Writing Applications	
Student Score Range		100-700	Pass+/ Pass/ Did Not Pass	Score	
			58	62	
			Score		
SAMPLE, OLIVIA C STN: 0000000000	605	Pass+	80	90	
SAMPLE, PAUL B STN: 0000000000	316	Did Not Pass	39	48	
SAMPLE, ROSE V STN: 0000000000	***	UND	***	***	
SAMPLE, XANDER M STN: 0000000000	577	Pass	85	95	

Figure 12. Class report.

Individual student report. Figure 13 shows Individual Student Report describe what students should know and be able to do in English/Language Arts, Mathematics, and Science. This Reports was created to measure whether students have learned what we expect them to know. Student Scores are scale scores that represent student achievement levels relative to the Academic Standards This report provides information on the student's achievement whether the student is meeting the minimum standard set for all students in the state.

We need to validate that the student demographic data is precisely accessible on student report. The student scores and proficiency rating should be well derived through performance standards.

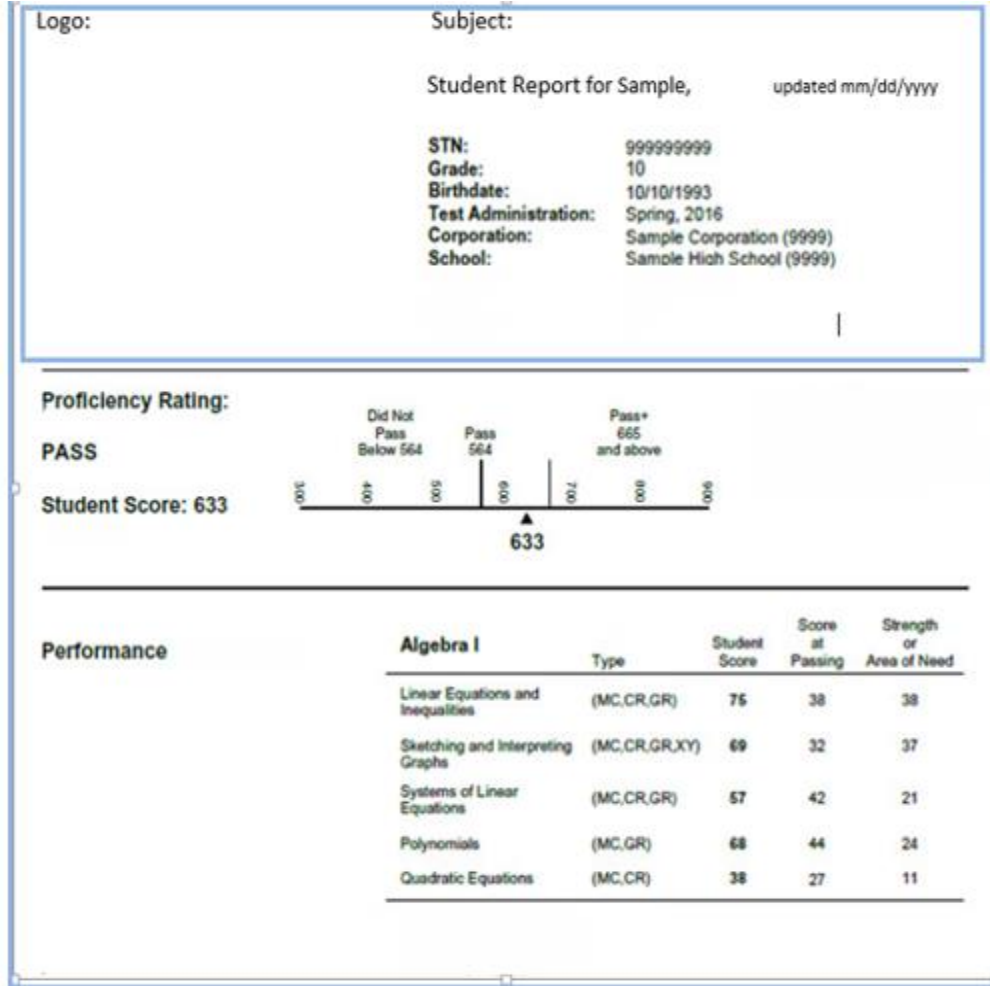


Figure 13. Student report.

Student file. The business team gets a student file from state having student and teacher information. The QA team needs to import the student file in the database. Once the file is imported in database QA needs to validate the data in state file with what has been loaded in the database. Figure 14 shows the Tables that the QA needs to build in SQL Server management studio.

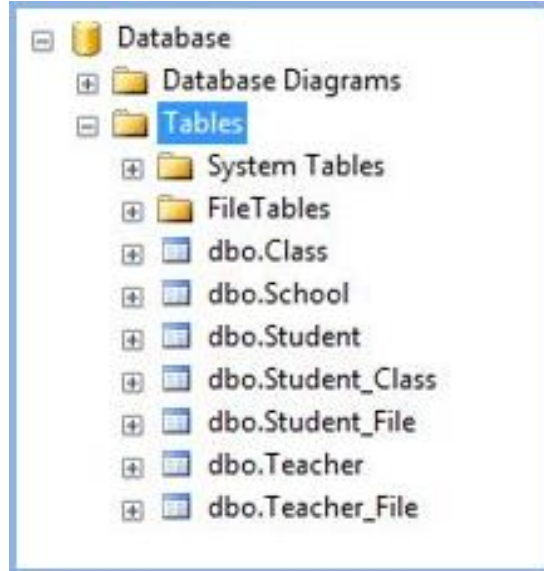


Figure 14. Database table.

QA creates two temporary tables Student file table and Teacher file table where all the data provided by state gets pulled and then the four tables gets populated.

- Student File table–The student file table contains the information about student demographic such as student identification number, first name, last name, D.O.B, gender, grade ,subject school name ,school no, class name as shown in Figure 15.

The screenshot shows a SQL query window with the following query:

```

1 SELECT [S I N]
2     , [First name ]
3     , [Lastname]
4     , [D O B]
5     , [Gender]
6     , [Grade]
7     , [TeacherNumber]
8     , [Subject]
9     , [SchoolName]
10    , [SchoolNumber]
11    , [ClassName]
12 FROM [ ]-[dbo].[Student_File]

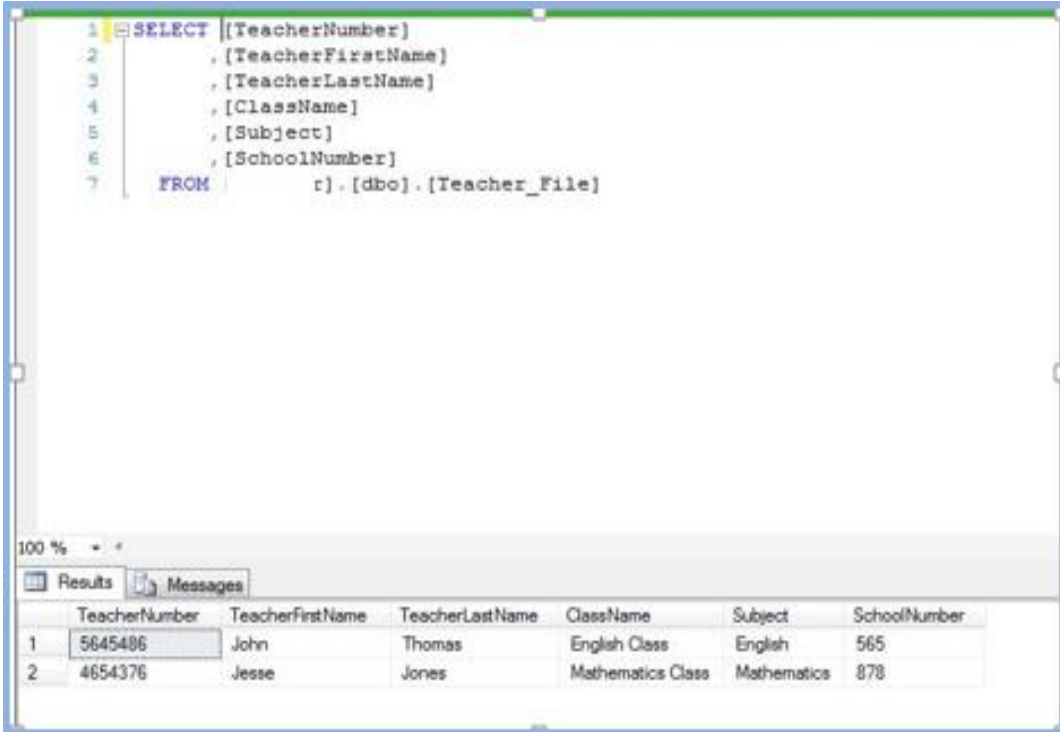
```

The results are displayed in a table with the following columns: S I N, First name, Lastname, D O B, Gender, Grade, TeacherNumber, Subject, SchoolName, SchoolNumber, and ClassName. The table contains 10 rows of data.

S I N	First name	Lastname	D O B	Gender	Grade	TeacherNumber	Subject	SchoolName	SchoolNumber	ClassName	
1	100000011	Terica	Shawn	2/2/2008	F	3	565	English	ABC Elementary School	565	English Class
2	100000012	Nick	Robert	2/12/2006	M	5	565	English	ABC Elementary School	565	English Class
3	100000013	Carol	Teff	11/10/2006	F	5	565	English	ABC Elementary School	565	English Class
4	100000014	Jan	Smith	1/10/2005	M	6	565	English	ABC Elementary School	565	English Class
5	100000014	Linda	Jones	9/9/2006	F	5	565	English	ABC Elementary School	565	English Class
6	100000016	Cathy	Taylor	3/3/2004	F	8	878	Mathematics	STAR Elementary School	878	Mathematics Class
7	100000017	Jhon	Lopez	6/6/2008	M	3	878	Mathematics	STAR Elementary School	878	Mathematics Class
8	100000018	Luke	Clark	7/21/2004	M	8	878	Mathematics	STAR Elementary School	878	Mathematics Class
9	100000019	Elly	Edwards	4/17/2003	F	9	878	Mathematics	STAR Elementary School	878	Mathematics Class
10	100000020	Nancy	Collins	3/15/2002	F	10	878	Mathematics	STAR Elementary School	878	Mathematics Class

Figure 15. Student file table.

- Teacher File table–It also holds details about teacher such teacher number, first and last name and class and the subject the teacher is associated with that class as shown in Figure 16.



The screenshot shows a SQL query window with a query editor at the top and a results pane at the bottom. The query editor contains the following SQL code:

```
1 SELECT [TeacherNumber]
2       , [TeacherFirstName]
3       , [TeacherLastName]
4       , [ClassName]
5       , [Subject]
6       , [SchoolNumber]
7 FROM [r].[dbo].[Teacher_File]
```

The results pane shows two rows of data:

	TeacherNumber	TeacherFirstName	TeacherLastName	ClassName	Subject	SchoolNumber
1	5645486	John	Thomas	English Class	English	565
2	4654376	Jesse	Jones	Mathematics Class	Mathematics	878

Figure 16. Teacher file table.

On the basis of Student file, Teacher file the four other tables—Teacher, School, Student and Class gets populated.

The image shows two side-by-side SQL query windows. The left window contains a query for the Teacher table, and the right window contains a query for the School table. Both windows show the results of the queries in a grid format below the query text.

Teacher Table Query:

```

1 SELECT [TeacherID]
2        , [FirstName]
3        , [LastName]
4        , [TeacherNumber]
5        , [SchoolNumber]
6 FROM [ ] . [dbo] . [Teacher]

```

TeacherID	FirstName	LastName	TeacherNumber	SchoolNumber
1	John	Thomas	5645486	565
2	Jesse	Jones	4654376	878

School Table Query:

```

1 SELECT [SchoolID]
2        , [SchoolName]
3        , [SchoolNumber]
4 FROM [ ] . [dbo] . [School]

```

SchoolID	SchoolName	SchoolNumber
1	ABC Elementary School	565
2	STAR Elementary School	878

Figure 17. Teacher table and school table.

As shown in Figure 17, Teacher table contains information about teacher ID, First Name, Last Name, Teacher number and School number. School table contains information about school id, School name and School number. School number is common field among both the table.

Student table contains demographic information such as student ID, student number, first name, last name, gender, D.O.B, grade as shown in Figure 18.

```

1 SELECT [StudentID]
2       , [StudentNumber]
3       , [FirstName]
4       , [LastName]
5       , [Gender]
6       , [DateOfBirth]
7       , [Grade]
8 FROM [ ] . [dbo] . [Student]

```

100 %

Results Messages

	StudentID	StudentNumber	FirstName	LastName	Gender	DateOfBirth	Grade
1	1	100000011	Temica	Shawn	F	2008-02-02	3
2	2	100000012	Nick	Robert	M	2006-02-12	5
3	3	100000013	Carol	Teff	F	2006-11-10	5
4	4	100000014	Jim	Smith	M	2005-01-10	6
5	5	100000014	Linda	Jones	F	2006-09-09	5
6	6	100000016	Cathy	Taylor	F	2004-03-03	8
7	7	100000017	Jhon	Lopez	M	2008-06-06	3
8	8	100000018	Luke	Clark	M	2004-07-21	8
9	9	100000019	Elly	Edwards	F	2003-04-17	9
10	10	100000020	Nancy	Colins	F	2002-03-15	10

Figure 18. Student table.

Class table contains information about Class ID, Teacher id, class name and subject as shown in Figure 19.

```

1 SELECT [ClassID]
2       , [TeacherID]
3       , [ClassName]
4       , [Subject]
5 FROM [ ] . [dbo] . [Class]

```

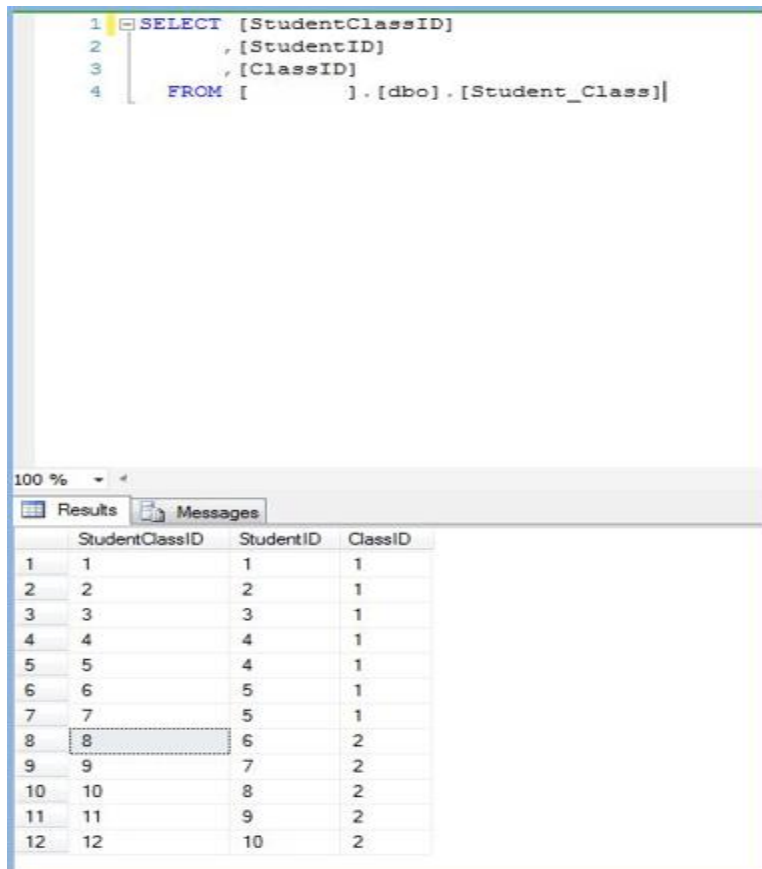
100 %

Results Messages

	ClassID	TeacherID	ClassName	Subject
1	1	1	English Class	English
2	2	2	Mathematics Class	Mathematics

Figure 19. Class table.

Final Table is Student-class table where it shows mapping between student and class table. This table validates the respective student maps to related class or not. Student ID is a unique key among the tables. Hence QA validates the student and teacher file provided by state making sure the students are correctly associated to appropriate class and school.



```
1 SELECT [StudentClassID]
2       , [StudentID]
3       , [ClassID]
4 FROM [   ] . [dbo] . [Student_Class]
```

	StudentClassID	StudentID	ClassID
1	1	1	1
2	2	2	1
3	3	3	1
4	4	4	1
5	5	4	1
6	6	5	1
7	7	5	1
8	8	6	2
9	9	7	2
10	10	8	2
11	11	9	2
12	12	10	2

Figure 20. Student class table.

Data Analysis

Product owners of the respective projects were responsible for showing every team's bi-weekly progress in sprint meeting. JIRA tool is used for analysis of the overall progress of the project.

- ✓ JIRA sprint board (in Figure 21) display the issues from the same project or multiple projects so the progress can be monitored from one place.
- ✓ Once the board is created, plan is the part where you can categorize the requirements (stories) into Sprints. Sprint is visible on boards and can be tracked with different status such as To Do, in progress, awaiting in QA, In QA, Done.

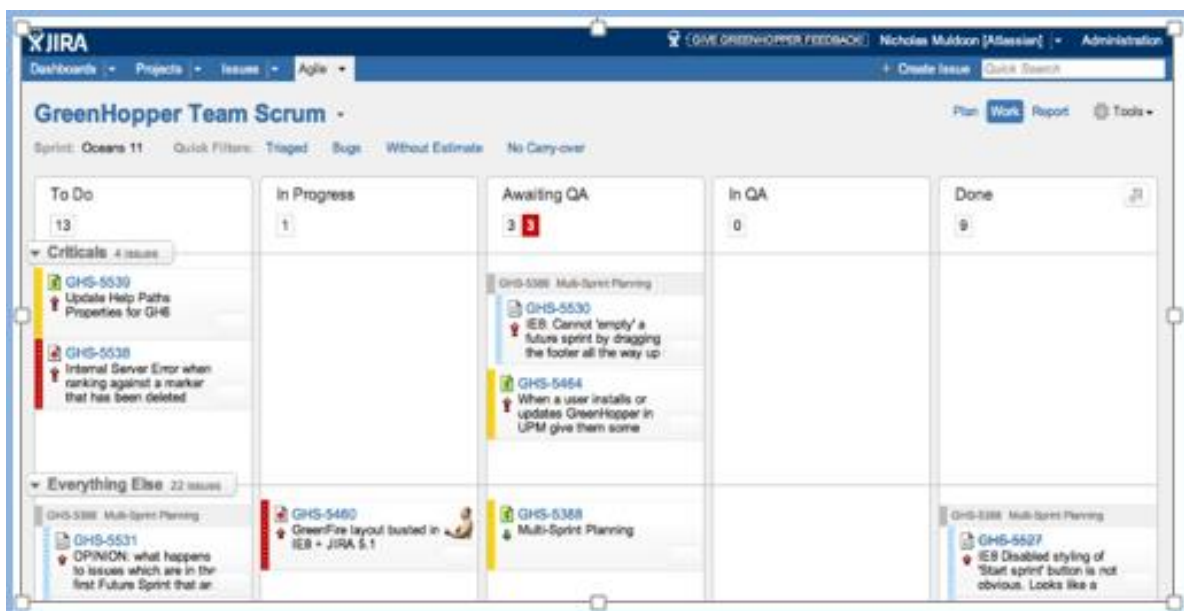


Figure 21. Sprint board.

Backlog in JIRA. A product backlog (shown in Figure 22) is a high level list of customer requirements for the project that is owned by the product owner/manager.

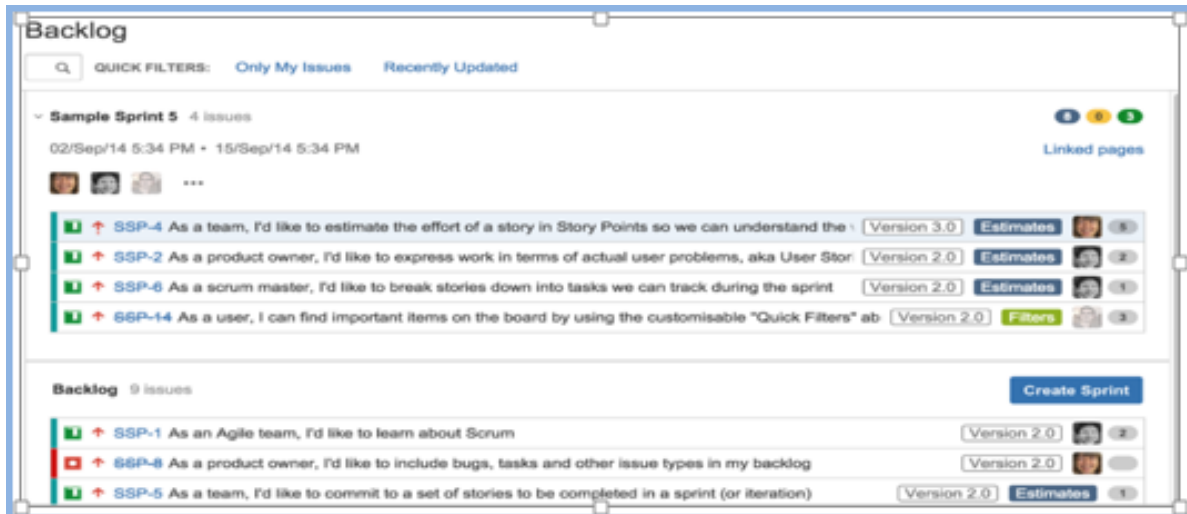


Figure 22. Backlog (Atlassian Documentation, 2016).

Figure 23 displays, backlog can be prioritized and moved to the active sprint.

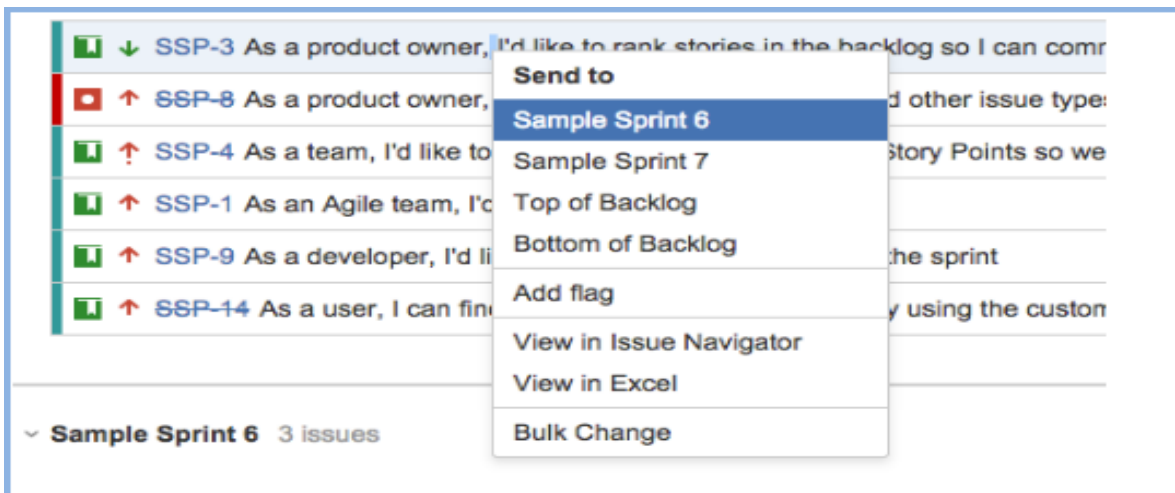


Figure 23. Backlog ranking (Atlassian Documentation, 2016).

Burndown chart. Burndown chart helps to track progress of the project by estimating the total work that needs to be done to achieve the sprint goal (Atlassian Documentation, JIRA Agile 6.5, 2016). Team can even track the remaining work throughout the iteration, to manage the progress.

A burndown chart shows the actual and estimated amount of work to be done in a sprint. As shown in Figure 24, the horizontal x-axis in a Burndown Chart indicates time, and the vertical y-axis indicates issues (Atlassian Documentation, JIRA Software Cloud, 2016).

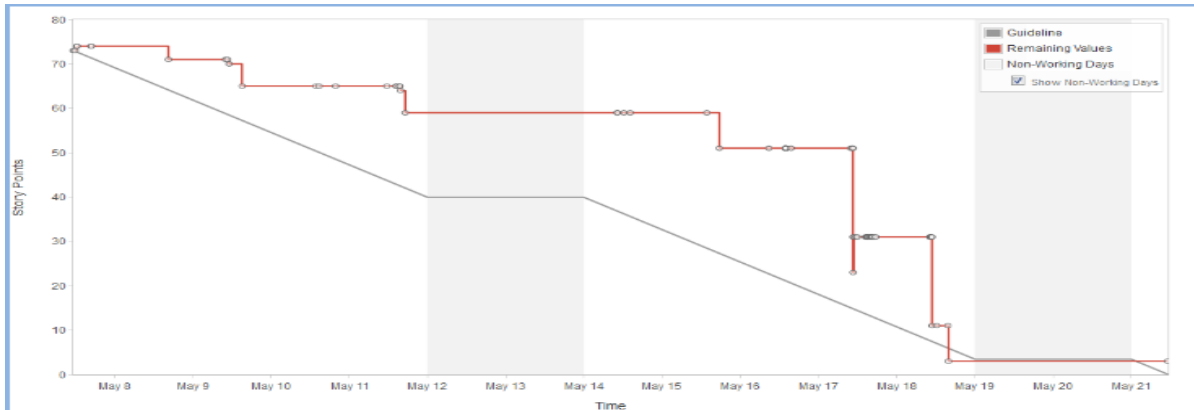


Figure 24. Burndown chart (Atlassian Documentation, JIRA Software Cloud, 2016).

Summary

This chapter summarize how student reports are validated. It also describe how JIRA sprint board, backlogs etc. can be managed with JIRA. Next chapter will provide insight about results, conclusion and recommendations.

Chapter V: Results, Conclusion, and Recommendations

Introduction

This chapter focused on the project results eventually obtained, the conclusion from these results and lastly the recommendations that were suggested during the implementation of the project.

Results

The Agile methodology implemented for QA process which helped in achieving project objectives with in timeline and allocated budget. Following project questions and their answer summarize project aspect.

Project Questions

1. **Que: What were the main problem of the current assessment system and how this project overcame these problems?**

Answer: Previous assessment system had communication gap between cross-functional team which often resulted inconclusive requirement. Status of work-flow was not visible cross all project team. Due to the waterfall nature, in case of requirement change, QA team created test plan and test cases from the start again. With the implementation of Agile methodology, communication improved across the project team and sprint helped team to manage constant change of requirements.

2. **Que: What were the merits of agile methodology in rapid changing environment compared to waterfall methodology which helped QA process to improve?**

Answer: Waterfall methodology depends to the great extent on initial business requirements. However, if a requirement error was found, or a change needs to be made, the project had to start from the start, which could have resulted increase in cost and time. Figure 25 shows typical waterfall vs agile methodology flow.

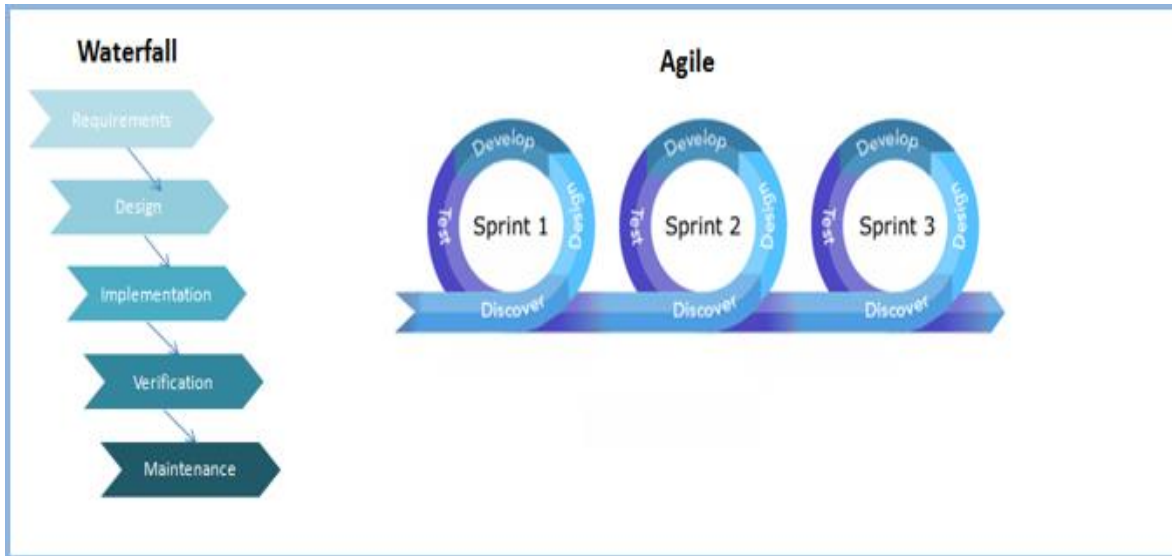


Figure 25. Waterfall vs agile flow.

One of the differences between agile and waterfall was the approach to quality and testing. In the waterfall model, there was always a separate testing phase after a build phase; however, in agile development testing was usually done concurrently with, or at least in the same iteration as, programming.

Because testing was done in every iteration, which developed a small pieces of the software, users could frequently use those new pieces of software and validated the value.

3. Que: What were the key benefits achieved after project was implemented successfully?

Answer: The Key benefits of project:

- ✓ It helped to manage high risk complex project.
- ✓ Self-managing team were extremely productive.
- ✓ Managing a release to deliver only highest valued functionality.
- ✓ Daily standup assisted to get status of task every day and gave opportunity to discuss road block in front of them team.
- ✓ The QA wrote test scripts and then validate the new code as it was being developed and hence provided feedback to development team immediately.
- ✓ Better commination.
- ✓ Defects were easy to fix.

4. Que: What were the defect count completed during various sprints which helped project team to improve overall project timeline, performance and projection?

Answer: With use of JIRA, team was able to plan and track better by creating user story and issue, plan sprints and distributed work across the team along with setting priority and tracking status. JIRA also helped team to manage release information and reports team's performance based on real time data.

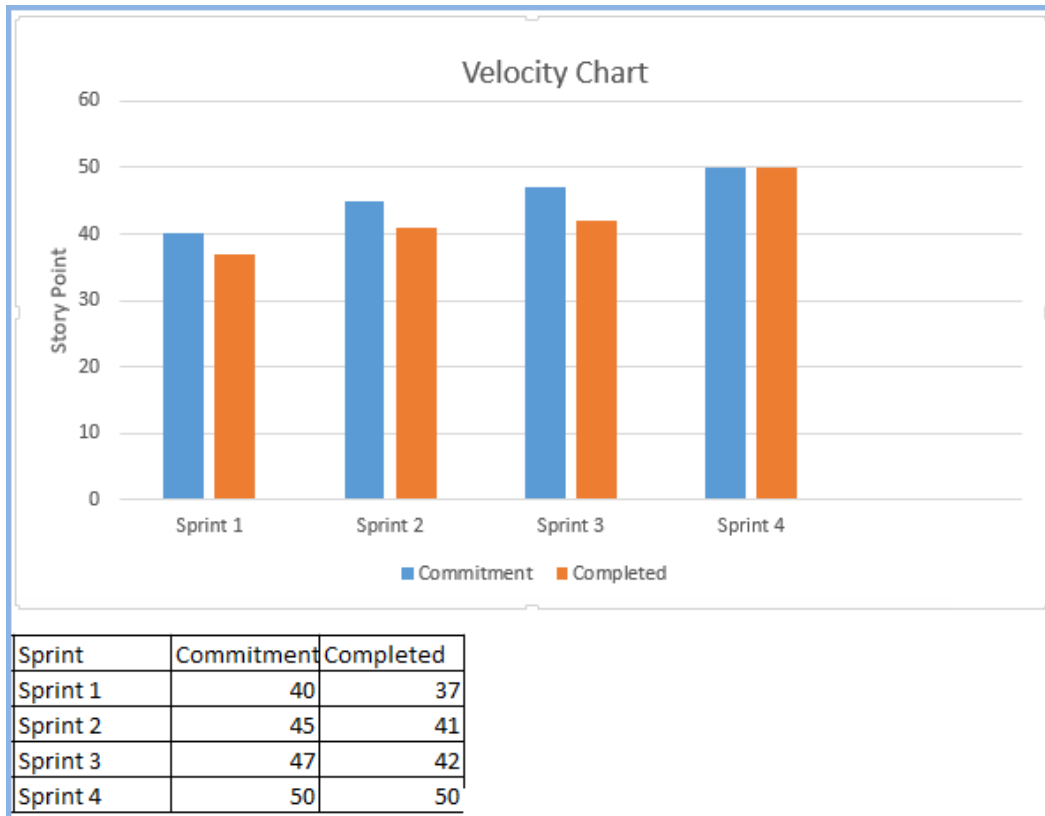


Figure 26. Velocity chart.

Figure 26 shows, the story point completed per sprint. This helped team to estimate amount of work for future sprint.

Conclusion

Assessment are critical for career growth of a student. The education industry focuses much attention on determining whether students are prepared to be successful in college or in a career. This Project helped to maintaining a high standard of quality to make assessment more efficient, scalable and effective. Successive spirit release generated quality product for different states.

Recommendations

Though the task was successfully executed there were few gray areas that needed consideration. Some of them are listed here:

- Agile principles are very demanding and require a big commitment for the duration of the project.
- Project requirements emerge and evolve throughout the development cycle and this can make it harder to define a business logic for the project, and harder to negotiate fixed price projects.
- To ensure quality testing is integrated throughout the lifecycle which effectively increases the cost of resources on the project.

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