SEABED: An Open-Source Software Engineering Case-Based Learning Database

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Case-Based Learning for Software Engineering

What is a Case?
A case is like a story, related to a real world situation that sources a number of challenging problems, which have no obvious solutions.

What is Case-Based Learning?
Case-based learning (CBL) is a teaching methodology based on discussing and analyzing real world situations.

SEABED
SEABED\(^a\) is an open source case-based learning web tool that contains a rich repository of Software Engineering (SE) cases.

\(^a\)http://www.seabed.in
Almost **No** practice of CBL for SE

- Software Engineering is a highly practice-oriented practical subject that requires decision making skills.
- There have been various applications of CBL in the fields of Medicine, Law, and Business.
- However, there are a limited number of evidences related to the application of CBL in the field of Software Engineering.

**Specific Research Aim**

Can we develop a web based platform where the students, instructors, practitioners, and experts enhance their SE knowledge in an effective way by implementing CBL?
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7. **References**
Garg et al. [3]
They exercised a case to teach the various aspects of software architecture and design, which engaged the learners in case solving and case listening activities, and contributed towards their communication skills.

Razali et al. [11]
They conducted a survey to prove the effectiveness of Case Methods in SE domain that helped the students to apply their theoretical knowledge in a realistic environment by putting themselves in the role of a decision maker.
**Kundra et al. [8]**

They have utilized CBL approach for teaching some important concepts of **compiler design**.

**Jia et al. [6]**

They presented a case study for **software design** phase.

**Fuller et al. [2]**

They proposed a new approach to teaching **software risk management** with case studies based on real projects which enabled the students to gain a practical experience in software development risk assessment.
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Novel and Unique Contributions

1. We propose the first multi-featured web based platform for CBL in the field of Software Engineering.

2. We propose an approach to build a SEABED community and implement our proposed approach to facilitate enough activity and users around SEABED, for the platform to reach a critical mass.

3. We present an experimental study to evaluate the outcomes of applying CBL to the basic Under Graduate (UG) level SE course at Dr. B. R. Ambedkar National Institute of Technology (NIT) \(^a\), Jalandhar.

\(^a\)http://www.nitj.ac.in
Creation of SEABED Platform

SEABED is designed using HTML, JavaScript, AJAX and PHP technologies. In addition to being a repository for the cases related to SE, SEABED has a variety of useful features. Some of them are:

- Case Submission
- Case Collection
- Case Search
- Case Evolution
- Case Collection
- Views and Opinions
Creation of SEABED Platform: SEABED Architecture

Case Submission Interface
- Title
- Author's Name
- Key Terms
- Submit

Case Collection Interface
- Category 1
- Category 2
- Category 3
- Category 4

Faceted Search Interface
- Search
- Term 1: Select
- AND/OR
- Term 2: Select
- Search

Collaboration and Evolution Interface
- Select Case
- Upload revision
- Upload justification
- Experience Report
- Upload report

Veena Saini, Paramvir Singh, Ashish Sureka
SEABED: Case Based Learning Platform
Creation of SEABED Platform: Case Submission

Title

First Name

Last Name

Email Address

Affiliation

Category

Key Terms

Abstract

Provide Right To Publish

I'm not a robot

Notify me regarding any activity for this Case.

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SEABED: Case Based Learning Platform
Creation of SEABED Platform: Case Collection

StalwartX

StalwartX (driver-less vehicle) is an emerging company with breakthrough technology. They are building autonomous and driver-less vehicles. Suppose you are a test manager at StalwartX. It is not easy to achieve self-driving capability under real-world conditions and requires a lot of perfection to create a car which can make decisions on its own. For acquisition of data from its surrounding, StalwartX is embedding the cars with eight cameras and one front facing radar. The car is equipped with a super computer, which uses a self-learning process (deep learning) so that it can tackle any situations. Self-driving serviceability varies with jurisdiction and relies heavily on comprehensive software validation and regulatory approval. These driverless vehicles are capable of controlling themselves with no or very less human interference. The security of the car heavily depends upon the area used to control this device. The car connects login to the Surf.

Browser Case

Topic covered in the class to undertake the study: Testing Principles, Testing Objectives, Unit Testing, Non-Functional Testing (response time, performance, load, and security)

Case: Suppose you are a Test Manager of Google Chrome. Everyone can associate with Google Chrome. Google Chrome is used by millions of people on various device types of different screen sizes—smartphone, desktop, laptop, tablets. chrome is ubiquitous; a full Google account integration gives you a variety of features that are not limited to a single device. Testing (response time) means the browser
Creation of SEABED Platform: Case Search

Term 1: Ashish
Field 1: Author
Term 2: Testing
Field 2: Category

Search Result
Title: (StalwartX)
FileName: (Security Testing Case(StalwartX).pdf)
upload/Security Testing Case(StalwartX).pdf Open File

Title: (Responsiveness Case)
FileName: (Google_Case.pdf)
upload/Google_Case.pdf Open File

Go back
Creation of SEABED Platform: Case Evolution

#821548 ALL IS WELL CASE
uploaded by Ashish, Paramvir and Yukti on 12/14/2016

Category: Design
Key Terms: Technology Stack, client and server side framework, data security
Abstract:
AI\W wants to set-up an online medical store to sell a wide range of medicines. You and your team need to select the technology stack.

View Case
download Case

Report1
uploaded by Ashish, Paramvir and Veena on 31 Jan 2017

Twitter Case
Twitter started as a side project of some of the employees of Odeon Inc. in 2006. It had immense growth nearly 1000% growth/year.
Uploaded by Ashish, Paramvir and Yukti on 2016-10-10

All Is Well Case
AI\W wants to set-up an online medical store to sell a wide range of medicines. You and your team need to select the technology stack for development.
Uploaded by Ashish, Paramvir and Yukti on 2016-10-10
In order to realize the full value of case-based teaching in the software engineering discipline an available collection of suitable cases is needed. This early effort of SEABED seems to be a move in the right direction for case pedagogy in software engineering.

---- Emanuel Grant || University of North Dakota
Table: Email Response Sheet

<table>
<thead>
<tr>
<th>Response</th>
<th>Instructor</th>
<th>Post-Doctoral Fellow</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Positive Feedback</td>
<td>19</td>
<td>2</td>
<td>21</td>
</tr>
<tr>
<td>Ready for Case Submission</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Ready for Case Revision</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Will implement cases in their classrooms</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>
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Community Creation Procedure

- Quality Control
- User Interaction
- Testimonials
- Recommendation System
- Promotion and Dissemination
- Guidelines and Templates
### SEABED Case Template

<table>
<thead>
<tr>
<th>Objectives and Goals</th>
<th>Relevance</th>
<th>Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Development</td>
<td>Focus</td>
</tr>
<tr>
<td>Domain</td>
<td>Design</td>
<td>Create surprise</td>
</tr>
<tr>
<td>Level</td>
<td>Tell a story</td>
<td>Affirmation</td>
</tr>
<tr>
<td>Size</td>
<td>Data</td>
<td>Legal Issues</td>
</tr>
</tbody>
</table>
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Experimental Setup

- The experimental study presented in this paper was carried out on a total of 89 B.Tech (UG) 3rd year (2014 batch) students from Computer Science and Engineering (CSE) branch of Dr. B. R. Ambedkar National Institute of Technology (NIT), Jalandhar.

- The overall exercise was conducted by a group comprising two faculty members, two Ph.D. research scholars and one M.Tech research scholar from the SE domain.

- This CBL exercise was assigned a weight-age of 6 out of 10 assignment marks for the SE course.

\[^{a}http://www.nitj.ac.in/\]
You are part of the SE team at All Is Well (AIW) Pharmacy Incorporation. AIW wants to set-up an online medical store to sell a wide range of medicines. You and your team need to select the technology stack for developing the online store.

- Server and client side framework
- Programming language
- Database
- Web-server
- Scalability

- Sign-in
- Data security
- Device responsiveness
- Payment methods
- Track delivery status
Case Questions

1. What are the various parameters that will form the basis for the selection of appropriate technologies or frameworks?

2. Identify various requirement conflicts and ambiguities, along with assumptions and major constraints that may potentially impact the selection of a technology stack.

3. Enlist the pros and cons of good and bad technology selection decisions with respect to the selection parameters.

4. Justify the selection of a particular technology stack with respect to the basic SE design principles.
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**Table:** Survey questions grouped by the respective learning principles

<table>
<thead>
<tr>
<th>Learning Technique</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning</td>
<td>Q1: I feel the use of case was relevant in learning about course concepts.</td>
</tr>
<tr>
<td>Critical Thinking</td>
<td>Q4: The case allowed me to view an issue from multiple perspectives.</td>
</tr>
<tr>
<td>Engagement</td>
<td>Q7: I was more engaged in class when using the case.</td>
</tr>
<tr>
<td>Communication Skills</td>
<td>Q9: The case discussion strengthened my communication skills to speak in front of the audience.</td>
</tr>
<tr>
<td>Team Work</td>
<td>Q10: The case discussion increased my confidence to work in a team.</td>
</tr>
</tbody>
</table>
Empirical Analysis and Evaluation

![Graph showing frequency scores for various learning principles]

**Figure:** Frequency Scores for various learning principles
### Table: Actual and Expected Observations

<table>
<thead>
<tr>
<th>Actual</th>
<th>Expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>Disagree</td>
</tr>
<tr>
<td>80.00</td>
<td>08.66</td>
</tr>
<tr>
<td>62.66</td>
<td>24.33</td>
</tr>
<tr>
<td>76.00</td>
<td>12.50</td>
</tr>
<tr>
<td>78.00</td>
<td>11.00</td>
</tr>
<tr>
<td>76.00</td>
<td>12.00</td>
</tr>
</tbody>
</table>

- **19.33%** strongly agreed (SA) and **55.20%** simply agreed (A).
- On average **13.70%** \((D = 12.07 \text{ and } SD = 1.63)\) disagree to have acquired the learning principles.
Challenges

- Reaching out to a critical mass, involving and engaging the practitioners for contribution, and quality control are three of the major challenges.
- Students found it difficult to switch from lecture-based learning to case-based learning.

Suggestions

Fixing the responsibilities for individual questions.

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SEABED: Case Based Learning Platform
Conclusion

- We propose a web based open source tool SEABED, based on case-based learning (CBL).
- This platform becomes useful when it reaches a wide mass of instructors willing to contribute cases and implement CBL in their classroom.
- CBL is found to be effective with an agreement of 74.53% students who were able to understand all five learning principles of learning, critical thinking, engagement, communication skills and team work.
Future Work

- We will add a variety of SE cases covering problems from different software development life cycle phases to the Case Collection section.

- We also target to conduct the experimental study on school going students and help them to develop critical thinking skills by understanding the course concepts well.
References I


References II


