A Case-Study on Teaching Software Engineering Concepts using a Case-Based Learning Environment

Kirti Garg, Vasudeva Varma, Ashish Sureka

IIIT-Hyderabad | International Institute of Information Technology, India
ABB, Bangalore, India

kirti@iiit.ac.in, vv@iiit.ac.in, ashish.sureka@in.abb.com

December 1, 2015
# Table of Contents

1. **Introduction**
   - Research Motivation and Aim
   - Background

2. **COSEEd Design**
   - COSEEd Introduction
   - COSEEd Primary Design Decisions
   - COSEEd Learning Cycle

3. **COSEEd Implementation and Evaluation**
   - COSEEd at IIIT Hyderabad
   - Evaluation of Cognitive Goals

4. **Conclusion and Discussion**

5. **References**
# Table of Contents

1. **Introduction**
   - Research Motivation and Aim
   - Background

2. **COSEEd Design**
   - COSEEd Introduction
   - COSEEd Primary Design Decisions
   - COSEEd Learning Cycle

3. **COSEEd Implementation and Evaluation**
   - COSEEd at IIIT Hyderabad
   - Evaluation of Cognitive Goals

4. **Conclusion and Discussion**

5. **References**
Research Motivation and Aim

- Improve state of SE education
- Design a flexible, highly reusable, holistic learning environment for learning and teaching of SE
- Build learning environment in-line with theories of learning and requirements of SE education
- Validate, through rigorous examination, that Case Based Learning approach is suitable for learning SE
Research Motivation and Aim

- Improve state of SE education
- Design a flexible, highly reusable, holistic learning environment for learning and teaching of SE
- Build learning environment in-line with theories of learning and requirements of SE education
- Validate, through rigorous examination, that Case Based Learning approach is suitable for learning SE
Research Motivation and Aim

- Improve state of SE education
- Design a flexible, highly reusable, holistic learning environment for learning and teaching of SE
- Build learning environment in-line with theories of learning and requirements of SE education
- Validate, through rigorous examination, that Case Based Learning approach is suitable for learning SE
Research Motivation and Aim

- Improve state of SE education
- Design a flexible, highly reusable, holistic learning environment for learning and teaching of SE
- Build learning environment in-line with theories of learning and requirements of SE education
- Validate, through rigorous examination, that Case Based Learning approach is suitable for learning SE
Case Studies promote *think forward from first principles*

Case based Learning can bring both theory and practice to learning by engaging students in contextualized and realistic learning [1, 2, 3].

Recent uses of case studies in SE education [4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19]. Most studies used some variation of a typical case study based approach used in management education.

Razali and Chitsaz [15] even prescribed a process of writing case studies for teaching SE.

Most reported work in experience reports, no rigorous or systematic evaluation seen so far.

*Our goal is to fill this gap*
Background

- Case Studies promote *think forward from first principles*
- Case based Learning can bring both theory and practice to learning by engaging students in contextualized and real(istic) learning [1, 2, 3]
- Recent uses of case studies in SE education [4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19]. Most studies used some variation of a typical case study based approach used in management education.
- Razali and Chitsaz [15] even prescribed a process of writing case studies for teaching SE.
- Most reported work in experience reports, no rigorous or systematic evaluation seen so far
- *Our goal is to fill this gap*
Case Studies promote *think forward from first principles*

Case based Learning can bring both theory and practice to learning by engaging students in contextualized and real(isitic) learning [1, 2, 3]

Recent uses of case studies in SE education [4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19]. Most studies used some variation of a typical case study based approach used in management education.

Razali and Chitsaz [15] even prescribed a process of writing case studies for teaching SE.

Most reported work in experience reports, no rigorous or systematic evaluation seen so far

*Our goal is to fill this gap*
Case Studies promote *think forward from first principles*

Case based Learning can bring both theory and practice to learning by engaging students in contextualized and real(isitic) learning [1, 2, 3]

Recent uses of case studies in SE education [4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19]. Most studies used some variation of a typical case study based approach used in management education.

Razali and Chitsaz [15] even prescribed a process of writing case studies for teaching SE.

Most reported work in experience reports, no rigorous or systematic evaluation seen so far

Our goal is to fill this gap
Case Studies promote *think forward from first principles*

Case based Learning can bring both theory and practice to learning by engaging students in contextualized and real(isitic) learning [1, 2, 3]

Recent uses of case studies in SE education [4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19]. Most studies used some variation of a typical case study based approach used in management education.

Razali and Chitsaz [15] even prescribed a process of writing case studies for teaching SE.

Most reported work in experience reports, no rigorous or systematic evaluation seen so far

*Our goal is to fill this gap*
Background

- Case Studies promote *think forward from first principles*
- Case based Learning can bring both theory and practice to learning by engaging students in contextualized and real(isitic) learning [1, 2, 3]
- Recent uses of case studies in SE education [4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19]. Most studies used some variation of a typical case study based approach used in management education.
- Razali and Chitsaz [15] even prescribed a process of writing case studies for teaching SE.
- Most reported work in experience reports, no rigorous or systematic evaluation seen so far
- *Our goal is to fill this gap*
# Table of Contents

1. **Introduction**
   - Research Motivation and Aim
   - Background

2. **COSEEEd Design**
   - COSEEEd Introduction
   - COSEEEd Primary Design Decisions
   - COSEEEd Learning Cycle

3. **COSEEEd Implementation and Evaluation**
   - COSEEEd at IIIT Hyderabad
   - Evaluation of Cognitive Goals

4. Conclusion and Discussion

5. References
Introducing COSEEd

- COSEEd = Case Oriented learning environment for SE Education
- COSEEd is a complete learning environment, and not just the pedagogy
- Engages student in collaboratively solving challenges embedded in a context (case study), thereby engaging in authentic activities of a software engineer
- COSEEd embeds problem solving as a core skill
Introducing COSEEd

- COSEEd = Case Oriented learning environment for SE Education
- COSEEd is a complete learning environment, and not just the pedagogy
  - Engages student in collaboratively solving challenges embedded in a context (case study), thereby engaging in authentic activities of a software engineer
- COSEEd embeds problem solving as a core skill
Introducing COSEEd

- COSEEd = Case Oriented learning environment for SE Education
- COSEEd is a complete learning environment, and not just the pedagogy
- Engages student in collaboratively solving challenges embedded in a context (case study), thereby engaging in authentic activities of a software engineer
- COSEEd embeds problem solving as a core skill
Introducing COSEEd

- COSEEd = Case Oriented learning environment for SE Education
- COSEEd is a complete learning environment, and not just the pedagogy
- Engages student in collaboratively solving challenges embedded in a context (case study), thereby engaging in authentic activities of a software engineer
- COSEEd embeds problem solving as a core skill
Primary Design Decisions

- Using well-designed SE case studies as primary learning objects
- A hybrid of Case Based Reasoning, Didactic learning, and other learning theories
- Maintaining flexibility and reusability through modular design
- In-line with the nature of SE
Primary Design Decisions

- Using well-designed SE case studies as primary learning objects
- A hybrid of Case Based Reasoning, Didactic learning, and other learning theories
- Maintaining flexibility and reusability through modular design
- In-line with the nature of SE
Primary Design Decisions

- Using well-designed SE case studies as primary learning objects
- A hybrid of Case Based Reasoning, Didactic learning, and other learning theories
- Maintaining flexibility and reusability through modular design
- In-line with the nature of SE
Primary Design Decisions

- Using well-designed SE case studies as primary learning objects
- A hybrid of Case Based Reasoning, Didactic learning, and other learning theories
- Maintaining flexibility and reusability through modular design
- In-line with the nature of SE
Multipurpose role of SE Case Studies

As a Context for Problem Solving

As a Recording instrument

As a Unit for Reflection

As an Organization Medium

As a Unit of Practice

As a Medium to Include Higher Order Cognitive Skills

As a Prescribed Way to Think

Well-Designed SE Case studies
The COSEEEd Learning Cycle

1. Lectures
   - Theoretical aspects of SE & Problem Solving
   - Relevant Tutorials or assignments
   - Lectures
   - Readings
   - Lab Work
   - Assignment

2. Case Solving
   - Case assigned to solvers randomly or they volunteer
   - Listeners must read the case
   - Instructor posts Reflection
   - Multiple teams assigned same case
   - Solvers develop a solution for case challenges
   - Self-study of uncovered topics
   - Case Study
   - Reflection Qs
   - Evaluation Guidelines

3. Pre-Evaluations
   - Scaffolding sessions for solver teams
   - Clear doubts
   - Evaluate draft solutions
   - Ensure participation
   - Give Presentation guidelines
   - AV Recording

4. Presentation & Discussion
   - quiz for all
   - Solvers present solutions
   - Solutions discussed with listeners
   - Solvers present role play
   - Feedback & evaluation by instructor
   - Quiz
   - Presentation
   - Queries
   - Feedback
   - AV Recording

5. Reporting
   - Solvers report final solution, case & peer feedback
   - Offline discussions
   - Listeners submits Reflection report
   - Case and Peer Feedbacks
   - Detailed Case Solution
   - Reflections

Move to Next Cycle

Provide Knowledge

Improve Solution

Assimilate Learning

Kirti Garg, Vasudeva Varma, Ashish Sureka
Table of Contents

1. Introduction
   - Research Motivation and Aim
   - Background

2. COSEEEd Design
   - COSEEEd Introduction
   - COSEEEd Primary Design Decisions
   - COSEEEd Learning Cycle

3. COSEEEd Implementation and Evaluation
   - COSEEEd at IIIT Hyderabad
   - Evaluation of Cognitive Goals

4. Conclusion and Discussion

5. References
COSEEd at IIIT Hyderabad

- 4 course offerings, each offering is an implementation of COSEEd
  - Each topic uses one learning cycle of 11-14 days, s.t. 2-3 groups of 4-5 students each, are case solvers. Rest of the class is case listeners
  - Students are a mix of UG, PG and PGSSP (Industry Participants)
  - 320 valid responses from Post course survey
Introduction

COSEEd Design

COSEEd Implementation and Evaluation

Conclusion and Discussion

References

Evaluation of Cognitive Goals

COSEEd at IIIT Hyderabad

- 4 course offerings, each offering is an implementation of COSEEd
- Each topic uses one learning cycle of 11-14 days, s.t. 2-3 groups of 4-5 students each, are case solvers. Rest of the class is case listeners
- Students are a mix of UG, PG and PGSSP (Industry Participants)
- 320 valid responses from Post course survey
COSEEEd at IIIT Hyderabad

- 4 course offerings, each offering is an implementation of COSEEEd
- Each topic uses one learning cycle of 11-14 days, s.t. 2-3 groups of 4-5 students each, are case slvers. Rest of the class is case listeners
- Students are a mix of UG, PG and PGSSP (Industry Participants)
- 320 valid responses from Post course survey
COSEEd at IIIT Hyderabad

- 4 course offerings, each offering is an implementation of COSEEd
- Each topic uses one learning cycle of 11-14 days, s.t. 2-3 groups of 4-5 students each, are case solvers. Rest of the class is case listeners
- Students are a mix of UG, PG and PGSSP (Industry Participants)
- 320 valid responses from Post course survey
Evaluation for satisfying usual cognitive goals of a typical first course in SE

- Confidence Scores
  - Confidence Vs Actual Scores
  - Communication Skills
  - Other Related Observations
Evaluation for satisfying usual cognitive goals of a typical first course in SE

- Confidence Scores
- Confidence Vs Actual Scores
- Communication Skills
- Other Related Observations
Evaluation for satisfying usual cognitive goals of a typical first course in SE

- Confidence Scores
- Confidence Vs Actual Scores
- Communication Skills
- Other Related Observations
Evaluation for satisfying usual cognitive goals of a typical first course in SE

- Confidence Scores
- Confidence Vs Actual Scores
- Communication Skills
- Other Related Observations
Confidence Scores (1)

- Using student's sense of self-confidence in architecture and design related competencies
  - five choices: cannot do at all, lots of help required, some help, very little help and without any help
Confidence Scores (1)

- Using student’s sense of self-confidence in architecture and design related competencies
- Five choices: cannot do at all, lots of help required, some help, very little help and without any help

![Confidence Scores Table]

<table>
<thead>
<tr>
<th>Competency</th>
<th>Can't do at all</th>
<th>Lots of help</th>
<th>Some help</th>
<th>Very little help</th>
<th>Without any help</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify ArchDrivers</td>
<td>3</td>
<td>17</td>
<td>85</td>
<td>140</td>
<td>74</td>
</tr>
<tr>
<td>Choose Arch Style</td>
<td>3</td>
<td>18</td>
<td>91</td>
<td>137</td>
<td>70</td>
</tr>
<tr>
<td>Decide Arch Strategy</td>
<td>2</td>
<td>13</td>
<td>45</td>
<td>72</td>
<td>23</td>
</tr>
<tr>
<td>Realize Classes</td>
<td>2</td>
<td>5</td>
<td>48</td>
<td>83</td>
<td>112</td>
</tr>
<tr>
<td>OODesign</td>
<td>2</td>
<td>17</td>
<td>95</td>
<td>115</td>
<td>90</td>
</tr>
</tbody>
</table>

Kirti Garg, Vasudeva Varma, Ashish Sureka
CMCE 2015 Workshop @ APSEC 2015
Confidence Scores (2)

- At least 60% of students felt they could accomplish the tasks, across all categories, with little help.
- Students were more confident of Design tasks than architecture-related tasks.
Confidence Scores (2)

- At least 60% of students felt that they can accomplish the tasks, across all categories, with little help.
- Students more confident of Design tasks than of architecture related tasks.
Confidence Scores (2)

- atleast 60% students felt that they can accomplish the tasks, across all categories, with little help
- Students more confident of Design tasks than of architecture related tasks
Confidence Scores (2)

- At least 60% students felt that they can accomplish the tasks, across all categories, with little help.
- Students more confident of Design tasks than of architecture related tasks.
Confidence Vs Actual Scores (1)

- Actual scores computed from competency related course artifacts, like exam solutions and case solutions, produced by students
- Actual scores lower, but not much than confidence scores

![Bar Chart]

- Confidence Perception
- Actual Score
Confidence Vs Actual Scores (1)

- Actual scores computed from competency related course artifacts, like exam solutions and case solutions, produced by students
- Actual scores lower, but not much than confidence scores
Confidence Vs Actual Scores (2)

- 50% students, did the competency tasks with no or very little help (highest score, or minor problems with their solutions), as compared to about 60% who showed similar confidence in perception scores.
50% students, did the competency tasks with no or very little help (highest score, or minor problems with their solutions), as compared to about 60% who showed similar confidence in perception scores.
50% students, did the competency tasks with no or very little help (highest score, or minor problems with their solutions), as compared to about 60% who showed similar confidence in perception scores.
Confidence Vs Actual Scores (3)

- Result trend similar to what seen in perception scores
Confidence Vs Actual Scores (3)

- Result trend similar to what seen in perception scores
Confidence Vs Actual Scores (3)

- Result trend similar to what seen in perception scores
Confidence Vs Actual Scores (3)

- Result trend similar to what seen in perception scores
Confidence Vs Actual Scores (4)

- Deeper analysis of Case Solvers Vs Case Listeners suggest that solvers exhibit higher learning gains
- 65.8% of Case Solvers vs 47.6% of case listeners feel that they can do the task with very little or no help at all

Actual Score (Binned) - Learning mode Cross-Tabulation (CS: Case Solving, CL: Case Listening)

<table>
<thead>
<tr>
<th></th>
<th>CL</th>
<th>CS</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>I can’t do the task at all</td>
<td>140 (14.2%)</td>
<td>12 (6.7%)</td>
<td>152 (13.1%)</td>
</tr>
<tr>
<td>I will need a lot of help</td>
<td>143 (14.5%)</td>
<td>1 (0.6%)</td>
<td>144 (12.4%)</td>
</tr>
<tr>
<td>I will need some help</td>
<td>232 (23.6%)</td>
<td>48 (27.0%)</td>
<td>280 (24.1%)</td>
</tr>
<tr>
<td>I will need very little help</td>
<td>304 (30.9%)</td>
<td>48 (27.0%)</td>
<td>352 (30.3%)</td>
</tr>
<tr>
<td>I will not require any help</td>
<td>164 (16.7%)</td>
<td>69 (38.8%)</td>
<td>233 (20.1%)</td>
</tr>
</tbody>
</table>

983 | 178 | 1161
Technical Communication Skills

- Students asked to self-report their communication skills
- Overall offerings, students felt that Case solving contributed most towards improving their communication skills

![Graph showing the perception scores for communication skills over years]
Other Related Observations

- Nature of topic is a compounding factor
- Student involvement impacts learning
- Class discussions are important
- Scaffolding, collaborative work, and well-set expectations improved quality of work, hence supported learning in Case oriented learning
- Authentic case studies are more effective
- Clear grading criteria improved administrative ease of COSEEd
- Openness to multiple right answers improves grading and discussion
Other Related Observations

- Nature of topic is a compounding factor
- Student involvement impacts learning
  - Class discussions are important
  - Scaffolding, collaborative work, and well-set expectations improved quality of work, hence supported learning in Case oriented learning
  - Authentic case studies are more effective
  - Clear grading criteria improved administrative ease of COSEEd
- Openness to multiple right answers improves grading and discussion
Other Related Observations

- Nature of topic is a compounding factor
- Student involvement impacts learning
- Class discussions are important
  - Scaffolding, collaborative work, and well-set expectations improved quality of work, hence supported learning in Case oriented learning
- Authentic case studies are more effective
- Clear grading criteria improved administrative ease of COSEEd
- Openness to multiple right answers improves grading and discussion
Other Related Observations

- Nature of topic is a compounding factor
- Student involvement impacts learning
- Class discussions are important
- Scaffolding, collaborative work, and well-set expectations improved quality of work, hence supported learning in Case oriented learning
- Authentic case studies are more effective
- Clear grading criteria improved administrative ease of COSEEEd
- Openness to multiple right answers improves grading and discussion
Other Related Observations

- Nature of topic is a compounding factor
- Student involvement impacts learning
- Class discussions are important
- Scaffolding, collaborative work, and well-set expectations improved quality of work, hence supported learning in Case oriented learning
- Authentic case studies are more effective
- Clear grading criteria improved administrative ease of COSEEd
- Openness to multiple right answers improves grading and discussion
Other Related Observations

- Nature of topic is a compounding factor
- Student involvement impacts learning
- Class discussions are important
- Scaffolding, collaborative work, and well-set expectations improved quality of work, hence supported learning in Case oriented learning
- Authentic case studies are more effective
- Clear grading criteria improved administrative ease of COSEEd
- Openness to multiple right answers improves grading and discussion
Other Related Observations

- Nature of topic is a compounding factor
- Student involvement impacts learning
- Class discussions are important
- Scaffolding, collaborative work, and well-set expectations improved quality of work, hence supported learning in Case oriented learning
- Authentic case studies are more effective
- Clear grading criteria improved administrative ease of COSEEdd
- Openness to multiple right answers improves grading and discussion
# Table of Contents

1. Introduction
   - Research Motivation and Aim
   - Background

2. COSEEd Design
   - COSEEd Introduction
   - COSEEd Primary Design Decisions
   - COSEEd Learning Cycle

3. COSEEd Implementation and Evaluation
   - COSEEd at IIIT Hyderabad
   - Evaluation of Cognitive Goals

4. Conclusion and Discussion

5. References
Conclusions

- Designing for SE education is complex and requires a systematic approach
- We designed a Case Study oriented Learning environment for SE education
- Our experimental analysis reveals that the model successfully covers cognitive goals of a typical SE course
- COSEEd was also useful for nurturing communication skills of SE students
Conclusions

- Designing for SE education is complex and requires a systematic approach.
- We designed a Case Study oriented Learning environment for SE education.
- Our experimental analysis reveals that the model successfully covers cognitive goals of a typical SE course.
- COSEEd was also useful for nurturing communication skills of SE students.
Conclusions

- Designing for SE education is complex and requires a systematic approach
- We designed a Case Study oriented Learning environment for SE education
- Our experimental analysis reveals that the model successfully covers cognitive goals of a typical SE course
- COSEEd was also useful for nurturing communication skills of SE students
Conclusions

- Designing for SE education is complex and requires a systematic approach.
- We designed a Case Study oriented Learning environment for SE education.
- Our experimental analysis reveals that the model successfully covers cognitive goals of a typical SE course.
- COSEEd was also useful for nurturing communication skills of SE students.
# Table of Contents

1. Introduction  
   - Research Motivation and Aim  
   - Background

2. COSEEd Design  
   - COSEEd Introduction  
   - COSEEd Primary Design Decisions  
   - COSEEd Learning Cycle

3. COSEEd Implementation and Evaluation  
   - COSEEd at IIIT Hyderabad  
   - Evaluation of Cognitive Goals

4. Conclusion and Discussion

5. References
References I


Shawn A Butler.  
A client/server case study for software engineering students.  

T B Hilburn, M Towhidnejad, S Nangia, and Shen Li.  
A Case Study Project for Software Engineering Education.  

Joan Krone, David Juedes, and Meera Sitharam.  
When theory meets practice: Enriching the CS curriculum through industrial case studies.  

Nancy R Mead and ED Hough.  
Megha Mittal and Ashish Sureka.  
Process mining software repositories from student projects in an undergraduate software engineering course.  

P K Raju, Chetan S Sankar, G Halpin, and G Halpin.  
Bringing theory and practice together in engineering classrooms.  

Mary Beth Rosson, John M Carroll, Con M Rodi, Mary Beth Rosson, John M Carroll, and Con M Rodi.  

Yanxia Jia and Yonglei Tao.  
Teaching Software Design Using a Case Study on Model Transformation.  
References IV

Jianmin Zhang and Jian Li.
Teaching Software Engineering Using Case Study.
Biomedical Engineering and Computer Science (ICBECS), 2010 International Conference on, pages 1–4, 2010.

R Razali and Dzulaiha Aryanee Putri Zainal.
International Education Studies, 6(6), May 2013.

R Razali and M Chitsaz.
Cases development for teaching software engineering.

S. Sripada, Y.R. Reddy, and A. Sureka.
In support of peer code review and inspection in an undergraduate software engineering course.
A Fuller, P Croll, and Limei Di.  
A new approach to teaching software risk management with case studies.  


Kirti Garg and Vasudeva Varma.  
A Study of the Effectiveness of Case Study Approach in Software Engineering Education.  

Agnar Aamodt and Enric Plaza.  
Case-Based Reasoning: Foundational Issues, Methodological Variations, and System Approaches.  
References VI

Jocelyn Armarego.
Learning from Reflection: Practitioners as Adult Learners.

Ray Bareiss, Martin Griss, Ray Bareiss, and Martin Griss.
A story-centered, learn-by-doing approach to software engineering education.

John D Bransford, Ann L Brown, and Rodney R Cocking.
How People Learn: Brain, Mind, Experience, and School.

John M Carroll and Mary Beth Rosson.
A case library for teaching usability engineering.

Allan Collins, John Seely Brown, and A Holum.
Cognitive apprenticeship: Making thinking visible.
References VII

Peter Freeman.
Essential elements of software engineering education Revisited.

Kirti Garg and Vasudeva Varma.
An effective learning environment for teaching problem solving in software architecture.

Carlo Ghezzi and D Mandrioli.
The challenges of software engineering education.

Jerald M Henderson.
A Case for Cases.
*Educational Research and Methods, 1978.*
References VIII

Kim Hyeonjin.
Situated learning with cases: Web-enhanced case-based reasoning in teacher education.
PhD thesis, University of Georgia, University of Georgia, Athens, Georgia, 2005.

D.M. Irby.
Three exemplary models of case-based teaching.

David H Jonassen.
Instructional design models for well-structured and ill-structured problem-solving learning outcomes.

Jamie Kirkley.
Principles for Teaching Problem Solving.

David R Krathwohl.
A Revision of Bloom’s Taxonomy: An Overview.
L R Mustoe and A C Croft.
Motivating engineering students by using modern case studies.

P K Raju and Chetan S Sankar.
Teaching Real-World Issues through Case Studies.

Roger C Schank and C Cleary.
Engines for Education - Roger Carl Schank, Chip Cleary - Google Books.

Donald A Schön.
Educating the reflective practitioner.

Benson P Shapiro.
Hints for Case Teaching.
References

**W Tellis.**
Introduction to Case Study.
*The Qualitative Report, 1997.*

**R K Yin.**
*2009.*
Thank you!

Contact:  kirti@iiit.ac.in
          vv@iiit.ac.in
          ashish@in.abb.com