An Industrial Case Study of the Impact of Domain Ignorance on the Effectiveness of Requirements Idea Generation during Requirements Elicitation

Skip to Slide 14

Ali Niknafs and Daniel M. Berry

David R. Cheriton School of Computer Science
University of Waterloo
Waterloo, Ontario, Canada

18 July 2013

Outline

Introduction, Definition of RE

The process of arriving at a specification of a set of features that need to be developed is referred to as *requirements engineering (RE)*.

The Role of People in RE

- Of the three Ps, *process, product, and people*, in software engineering, people have been least scrutinized.
- Boehm observed that the quality of the development personnel is the most powerful factor in determining an organization's software productivity.
- While there is empirical evidence of the importance of the quality of the personnel in software development, there is not much in RE.

The Role of People in RE

The qualifications of the personnel involved in an RE process highly affects the effectiveness of the process, but most decisions about staffing RE teams arise from anecdotes and folklore, not from scientific studies.

The RE Gap

- One issue in RE is the gap between what the customer wants and what the analyst thinks the customer wants.
- To bridge this gap, many believe that an analyst needs to know the customer's problem domain well to do RE well for a system in the domain.
- However, deep knowledge of the problem domain can lead to falling into the *tacit assumption tarpit*.

Benefits of Domain Ignorance

The benefits of domain ignorance include:

- the ability to think out of the domain's box, leading to ideas that are independent of the domain assumptions,
- the ability to ask questions that expose the domain's tacit assumptions, leading to a common explicit understanding.

First Observations of Benefits of Ignorance

Probably, the earliest observation of the benefits of ignorance was Burkinshaw's statement during the 1969 Second NATO Conference on Software Engineering:

> *Get some intelligent ignoramus to read through your documentation and try the system; he will find many "holes" where essential information has been omitted. Unfortunately intelligent people don't stay ignorant too long, so ignorance becomes a rather precious resource. Suitable late entrants to the project are sometimes useful here.*

First Observations of Benefits of Ignorance

In 1995, Berry observed the benefits of domain ignorance when he performed better than expected when he helped specify requirements for software in domains he was quite ignorant of.

Context of the Study

In this study, requirements engineers perform an RE task that generates things, such as requirement ideas for some *computer-based system (CBS)* for some *client*.

- The CBS is situated in some *domain*, and at least one member of the client's organization is at least *aware of* and is often expert in this domain.
- Each member of the software development organization doing the RE activities has a different amount of *knowledge about the domain*. Each is either:
  - *Ignorant of the domain*, i.e., is a ***domain ignorant (DI)***.
  - *Aware of the domain*, i.e., is a ***domain aware (DA)***.
- Each of domain ignorance and domain awareness is a kind of *domain familiarity*.

Goal of the study

Main Goal

To form the most effective teams of requirements engineers.

Underlying Research Question

Does a mix of DIs and DAs perform an RE activity more effectively than only DAs?

Goal of the study

Main Goal

To form the most effective teams of requirements engineers.

Underlying Research Question

Does a mix of DIs and DAs perform an RE activity more effectively than only DAs?

Our Previous Work

- Preliminary results were reported at the last RE Conference!
- We conducted a controlled experiment on 20 teams of all different combinations of DIs and DAs, testing

Main Hypothesis

A team consisting of a mix of DIs and DAs is more effective in an RE activity than is a team consisting of only DAs.

- We tested whether other factors, i.e., creativity, RE experience, and industrial experience, affected the results.

Our Previous Work

Main Conclusion w.r.t Main Hypothesis:

A team with a mix of domain familiarities *is* more effective in requirements idea generation than is a team with either

- only DIs or
- only DAs.

The Case Study

This case study was to corroborate the conclusions of the controlled experiment, by:

- getting one group with a mix of DAs and DIs to carry out the idea generation part of a requirements idea brainstorming session, and ...
- then asking the DA members of the group to compare the case study session with previous DA-only sessions.

Case Study Context

We carried out the idea generation part of a brainstorming session in a company, *C*, ...

- to generate requirement ideas for a system, *S*, ...
- situated in a specific domain, *D*, ...
- to be developed as one of *C*'s products.

Case Study Context, Cont'd

- The session had 8 participants,
  - 4 of which came from *C* and
  - 4 of which came from the University of Waterloo (UW).
- We assumed that
  - the 4 *C* developers were DAs w.r.t. *D* and
  - the 4 UW people, not working at *C*, were DIs w.r.t. *D*.

Case Study Procedure

- At the beginning of the session, the supervisor among the DAs gave a brief description of *S*,
  - because in a brainstorming session, everyone must be at least aware of the problem to be solved.
- Although no DI knew the problem beforehand,
  - each had some familiarity with *D* and ...
  - each had some acquaintance with *C* products.
- Then, the team started generating ideas for requirements for *S* in *D*.

Data Collection

Making Observations During the Session

- One author, a DI, monitored the session's generated ideas only to analyze the relation between ideas.
- All ideas were *C*'s IP; no idea was to leave the room; thus, we did not record any idea's contents.

Making Observations

- For each idea, the monitoring author noted
  - who generated it and ...
  - whether it was new (relative to the session) and ...
  - which idea, if any, it was built on.
- Another DI monitored the session for another research study.
- Therefore,
  - 2 DIs were fully focused on generating requirement ideas, while ...
  - 2 DIs had responsibilities besides generating ideas.

Observations From the Session

- The DAs were less active than the DIs in the beginning of the session.
- The DAs became more active after DIs threw out some ideas.
- Many ideas offered by DIs appeared to be from outside *D*'s box.
- Nevertheless, it appears that DAs built on many of these apparent out-of-the-box ideas.

Results

Table: Summary of the Ideas Generated

	New Ideas (Discussion initiator)	Extensions	Total
DAs	12 (3)	15	27
Fully focused DIs	14 (7)	2	16
Partly focused DIs	8 (2)	1	9
Total	34 (12)	18	52

Feedback of the DAs

- We asked questions of the DAs in *C* after the session was over.
- Here are the questions and one sanitized representative answer for each.
- Due to the page limit, the paper gives only a summary of the answers.
- There were two rounds of questions, and some clearly follow up on previous questions.

Feedback of the DAs

Question 1

What were your impressions of the brainstorming session you had at the University of Waterloo?

Answer

It was pretty good, we had some interesting ideas. However we would have liked some more solid focus on actual APIs/implementation details required for how we could handle some of the ideas.

Feedback of the DAs

Question 1

What were your impressions of the brainstorming session you had at the University of Waterloo?

Answer

It was pretty good, we had some interesting ideas. However we would have liked some more solid focus on actual APIs/implementation details required for how we could handle some of the ideas.

Feedback of the DAs

Question 2

Did it go better, the same, or worse than sessions you have had at *C* with only *C* people?

Answer

It did not go any better or worse, but not the same as the *C* only brainstorming. There was a wider array of ideas but not as much depth to the ideas (like how it would be implemented, APIs required, etc.)

Feedback of the DAs

Question 2

Did it go better, the same, or worse than sessions you have had at *C* with only *C* people?

Answer

It did not go any better or worse, but not the same as the *C* only brainstorming. There was a wider array of ideas but not as much depth to the ideas (like how it would be implemented, APIs required, etc.)

Feedback of the DAs

Question 3

Did the outsiders contribute anything to the session that you believe you would not have gotten had there been *only C* people? Did the outsiders contribute anything of value to the session?

Answer

Yes, there were some things mentioned by the outsiders which were completely outside of the box. Their contributions required some refinement but it was interesting to hear different perspectives on how people use *S* and what they thought it could do.

Feedback of the DAs

Question 3

Did the outsiders contribute anything to the session that you believe you would not have gotten had there been *only C* people? Did the outsiders contribute anything of value to the session?

Answer

Yes, there were some things mentioned by the outsiders which were completely outside of the box. Their contributions required some refinement but it was interesting to hear different perspectives on how people use *S* and what they thought it could do.

Feedback of the DAs

Question 4

We noticed that you were not as active in the beginning as the outsiders. What caused you not to participate? Were you inhibited? If so, by what?

Answer

We wanted to hear about the ideas outsiders have and to learn the outsiders' level of knowledge of D, and only then to throw in our own ideas.

Feedback of the DAs

Question 4

We noticed that you were not as active in the beginning as the outsiders. What caused you not to participate? Were you inhibited? If so, by what?

Answer

We wanted to hear about the ideas outsiders have and to learn the outsiders' level of knowledge of *D*, and only then to throw in our own ideas.

Feedback of the DAs

Question 5

What prompted you to begin to participate when you did?

Answer

We found ideas generated by outsiders interesting enough that we felt compelled to build on them.

Feedback of the DAs

Question 5

What prompted you to begin to participate when you did?

Answer

We found ideas generated by outsiders interesting enough that we felt compelled to build on them.

Feedback of the DAs

Question 6

Many ideas seemed to be initiated by an outsider from outside *D*. It seemed that in many such cases, an expert built on these ideas. Did you observe this phenomenon?

Answer

(Each respondent said) Yes.
Outsiders have perspectives that are different from ours and can bring in new ideas.

Feedback of the DAs

Question 6

Many ideas seemed to be initiated by an outsider from outside *D*. It seemed that in many such cases, an expert built on these ideas. Did you observe this phenomenon?

Answer

(Each respondent said) Yes.
Outsiders have perspectives that are different from ours and can bring in new ideas.

Feedback of the DAs

Question 7

Did you participate in such a phenomenon? If so, what were your thoughts as you did so?

Answer

Yes. There were quite a few instances of this where an idea was brought up that did not seem to be relevant so I prodded with some additional information to try to make the idea more relevant to the context.

Feedback of the DAs

Question 7

Did you participate in such a phenomenon? If so, what were your thoughts as you did so?

Answer

Yes. There were quite a few instances of this where an idea was brought up that did not seem to be relevant so I prodded with some additional information to try to make the idea more relevant to the context.

Conclusions

- The DIs were generating out-of-the-box ideas.
- The DAs were interested in technical details, as they were seeking only implementable ideas. The DIs were oblivious to technical details and implementability.
- DAs are tied to solutions that they are already familiar with. One of the DAs said some of the ideas that DIs brought up were irrelevant to the problem. However, the DAs were often able to make an irrelevant idea worthy of follow up by modifying the idea to fit what they perceive as the domain D of C.

Conclusions

- Considering that the main purpose of the idea generation part of brainstorming is to generate as many ideas as possible, what the DA observed is about normal.
- There were indications that the DIs may have generated some ideas that were innovative to *C*. (Because of confidentiality they could not tell us for sure.)
- Ideas can be borrowed from domains different from *D*.
- Finally, the experience suggest that in company *C*, brainstorming groups should be composed of domain experts and new employees.

Future Work

Ask the manager in a year if any idea ended up being a product.

Expected Application of the Results

Help RE managers in forming teams that are performing knowledge-intensive RE activities, by

- providing a list of RE activities for which domain ignorance is at least helpful and
- providing advice on the best mix of DIs and DAs for any RE activity.
- providing a useful role for new hires that allows them to be productive from the start while learning about the domain slowly without being a time drain on their mentors.