A Controlled Experiment on Team Meeting Style in Software Architecture Evaluation

Dietmar Winkler Stefan Biffl Christoph Seemann

Institute of Software Technology and Interactive Systems,
Vienna University of Technology

dietmar.winkler@tuwien.ac.at

http://qse.ifs.tuwien.ac.at

Motivation

- Software architecture is a success-critical issue in software projects.
  - Defects and Changes can have a major impact on quality of delivered system, project duration, and cost.
  - Early consideration of non-functional requirements and quality attributes, e.g., modifiability, performance, and maintainability.

- Established architecture evaluation processes, e.g., ATAM.
  - Focus on scenarios, i.e., workflows and system properties derived from individual stakeholders.

- Scenario Brainstorming
  - Individuals and Teams
  - Team meeting styles: face-to-face meeting, tool-supported meetings, non-communicating “team-meetings” (nominal teams).

- Key research questions focus on:
  - Impact of meeting styles on scenario brainstorming performance.
  - Face-to-face meetings versus tool-supported meetings in real team meetings.
  - Impact of experience on meeting style.

Related Work

Software Architecture Evaluation

- Quality attributes can address upcoming needs (change categories).
- Efficient and effective review procedures for architecture evaluation.
- Architecture evaluation processes help systematically analyzing architecture variants.

Scenario Brainstorming

- Scenarios are the most important inputs to architecture evaluation approaches.
- Capturing most likely upcoming changes and classification of quality attributes (option: guiding scenario brainstorming with change categories).
- Different perspectives from various stakeholders within heterogeneous teams.

Team Meeting Collaboration

- Co-located teams and distributed teams.
- Face-to-face meeting and tool-supported team meetings.
- Real team meetings and nominal (non-communicating) teams.

Research Questions & Variables

Research Questions:

- Impact of various meeting styles on scenario brainstorming performance: face-to-face (F2F), tool-supported (TS) and non-communication meetings.
- Impact of team experience on team effectiveness.

Approach:

- Controlled experiment in academic environment.

Variables:

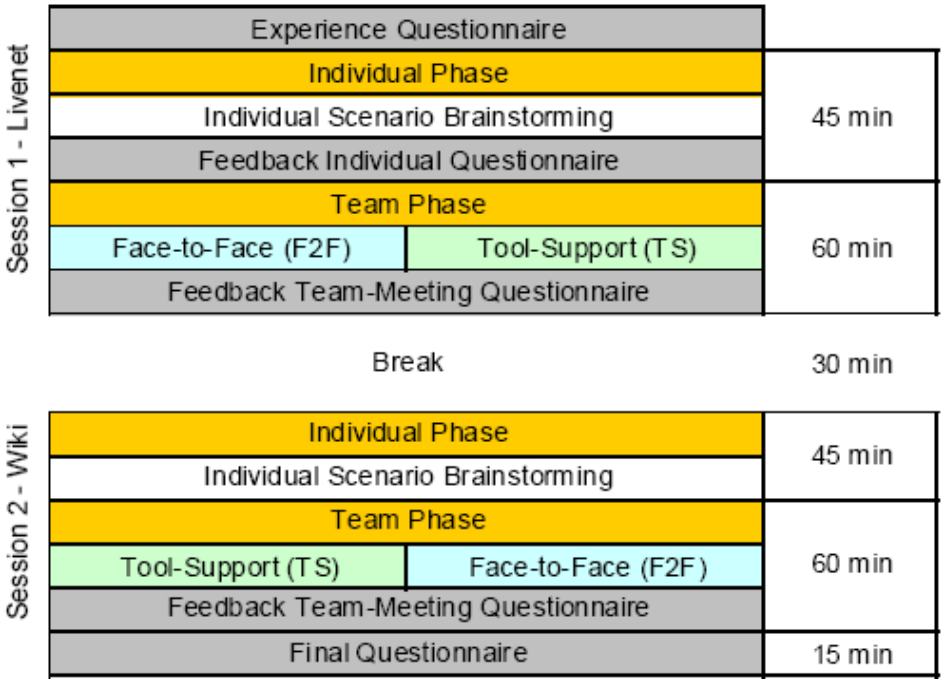
- Independent variables: Size of real and nominal teams; Individual experience (collected prior to the study) of the participants and the meeting styles.
- Dependent variables: Scenario brainstorming performance, i.e., number of identified individual (and team) scenarios; number of identified important scenarios (“TopScenarios”)

Hypothesis with focus on “TopScenarios”

- H1. Higher performance of F2F meeting style teams compared to TS meetings.
- H2. Higher share and number of reported TopScenarios in F2F meetings with respect to nominal teams.
- H3. Higher performance of more experienced reviewers in F2F meetings compared to TS meetings.

Empirical Study Design

- Two application domains in 2 sequential sessions:
  - Web-based Collaboration-tool.
  - Wiki-System.
- Cross over design for meeting styles.
- Material:
  - System requirements specification.
  - Questionnaires & Data Collection.
  - Supporting material (guidelines).
- Participants
  - Master students with technical background and industry experience.
  - Randomized group assignment.
  - Session 1: 54 individuals (16/3 and 3/2-person teams).
  - Session 2: 52 individuals (16/3 and 2/2-person teams).



Sequence of Experiment Steps.

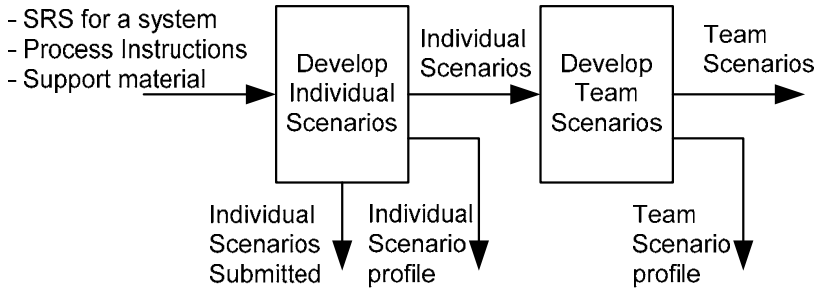
	Livenet	Wiki	Total
Tool-Support	30	22	52
Face-to-Face	24	30	54
Total	54	52	

Number of participants in both sessions.

Experiment Execution & Threats to Validity

Experiment Execution:

- Selection of participants, group assignment team composition.
- Lecture and briefing session prior to the study.
- Experiment execution in 2 sessions, each with
  - Individual Brainstorming
  - Team meeting (meeting style changed in the second session)



Experiment process in every session.

Validity Considerations:

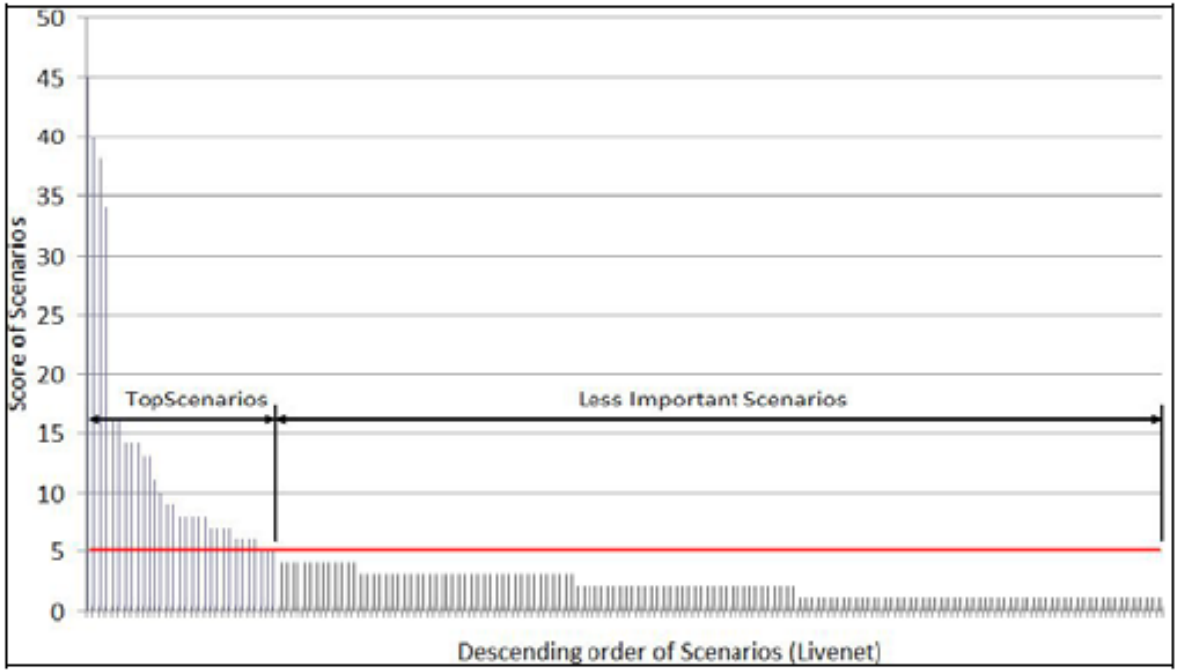
- Internal validity: randomized subject assignment, Collected subject experience, Feedback questionnaire, no communication during individual brainstorming tasks.
- External validity: classroom setting, similar background of participants, possible limited experience on the domain, short software requirements specification might not be typical in industry setting, possible learning effects in the second session.

Analysis & “Top Scenario” Profile

- Analysis of identified scenarios after the study based on frequency of scenario reports
- Scenario scoring is based on individuals and real team scenario profiles.
- 20%/80% distribution of reported scenarios.

	All scenarios	TopScenarios	Share
Livenet	174	31	18%
Wiki	193	39	20%

- Focus on most important scenarios.

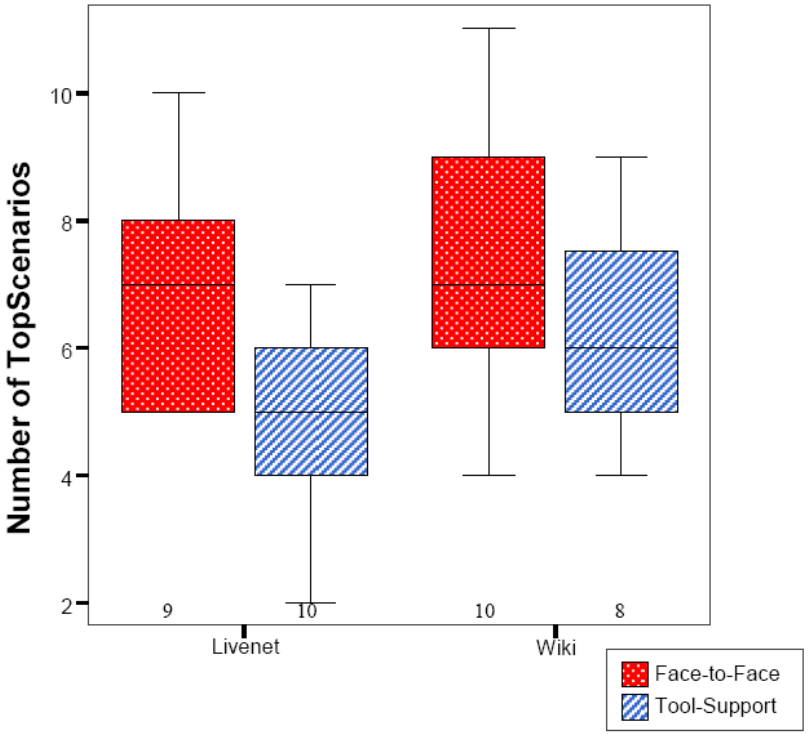


Face-to-Face vs. Tool Supported Meetings

H1: Face-to-Face Meeting vs. Tool-Supported Meetings

- Overall scenarios per meeting style in both sessions
  - Benefits for face-to-face meetings in both sessions.
  - No significant differences.
  - Higher number of reported scenarios in the second session

	Face-to-Face		Tool-Support		
	Mean	SD	Mean	SD	p-value
Livenet	10.6	2.19	8.5	2.88	0.113(-)
Wiki	11.3	3.59	9.4	3.16	0.274(-)



- TopScenarios per meeting style in both sessions
  - Similar results for TopScenarios.
  - No significant differences.

	Face-to-Face		Tool-Support		
	Mean	StdDev	Mean	StdDev	p-value
Livenet	6.9	1.96	5.0	1.63	0.035(-)
Wiki	7.5	2.32	6.3	1.67	0.203(-)

→ No significant differences regarding meeting style

Nominal Teams (Livenet – Session 1)

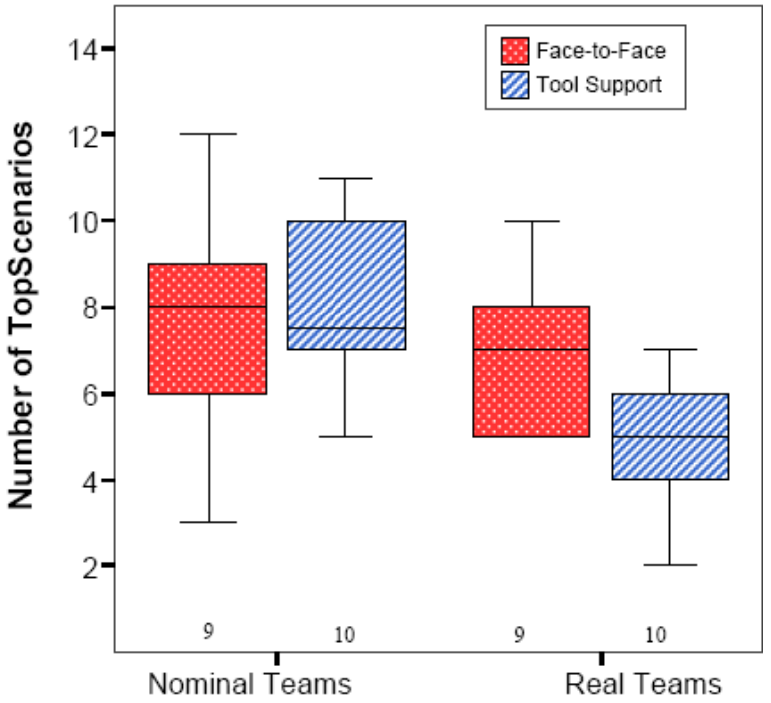
H2: Nominal vs. Real Teams in Session 1 (Livenet)

- Nominal teams:
  - No real team meeting.
  - “Meeting” without interaction (non-communicating teams)
  - Team scenario profiles are merged based on individual team scenario profiles.

- Nominal teams: on average benefits for tool supported meetings.
- Real teams: benefits for F2F team meetings.
- Share of TopScenarios is higher for real team meetings (F2F and TS)

→ Less important scenarios are excluded during real team meetings.

→ Focus on more important scenarios.



	Nominal Teams			Real Teams		
	ALL	TOP	%	ALL	TOP	%
F2F	14.2	7.1	50%	10.6	6.9	65%
TS	16.5	8.0	48%	8.5	5.0	59%

Note: F2F … face-to-face team meeting, TS … tool-supported team meeting.

Nominal Teams (Wiki – Session 2)

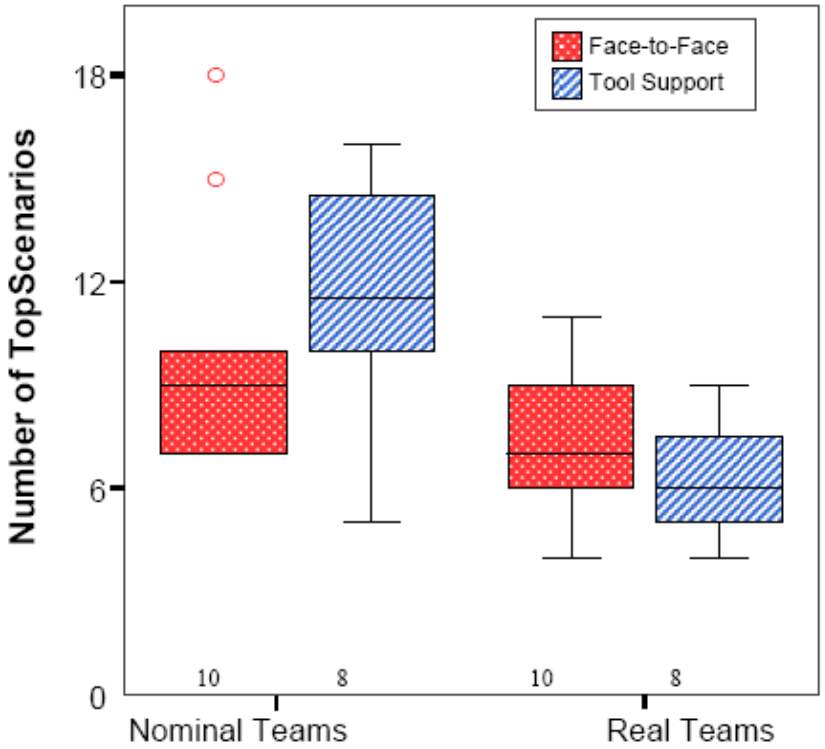
H2: Nominal vs. Real Teams in Session 2 (Wiki)

- Similar to Session 1:
  - Nominal teams: on average benefits for tool supported meetings.
  - Real teams: benefits for F2F team meetings.
  - Share of TopScenarios is higher for real team meetings
- Share of TopScenario increases
  - F2F: 2% for nominal teams and 1% for real teams.
  - TS: 12% for nominal teams and 8% for real teams.

→ Possible learning effect in 2nd session.

→ Significant differences for nominal teams, but no relation to meeting style (based individual scenario brainstorming).

→ Additional investigations required.



	Nominal Teams			Real Teams		
	ALL	TOP	%	ALL	TOP	%
F2F	18.7	9.9	52%	11.3	7.5	66%
TS	19.25	11.6	60%	9.4	6.3	67%

Note: F2F … face-to-face team meeting, TS … tool-supported team meeting.

Impact of Experience

H3: Impact of Experience on Meeting Style

- Experience Questionnaire prior to the study
  - Subjective estimation of experience based on project, quality assurance, and architecture review experience (Likert-Scale).
  - Participants were master students with technical background and industry experience.
  - Team experience calculation based on real teams settings.

	High-Experience		Less Experience		
	Mean	StdDev	Mean	StdDev	p-value
Livenet	6.1	1.7	5.7	2.3	0.662(-)
Wiki	7.5	2.7	6.5	1.5	0.330(-)

- No significant differences in both sessions (Livenet & Wiki).
  - There seems to be no relationship between team experience and the number of reported TopScenarios.
  - More detailed investigation with experience data and scenario profiles, e.g., modified experience calculation approach, and nominal team effects.

Conclusion and Further Work

- H1. Higher performance of F2F meeting style teams.
  - The results showed benefits for F2F meetings, but no significant differences.
  - Previous studies reported on significant benefits of TS meetings.
    Possible reasons: the applied collaboration tool might hinder efficient collaboration and communication.

  → Future work is to investigate reasons for these results in more detail.

- H2. Higher share and number of reported TopScenarios in F2F meetings with respect to nominal teams.
  - Assumption: Real team meetings can identify more important scenarios during interaction and discussion (an skip less important scenarios).
  - Nominal teams: advantages for tool-supported meetings; real teams: benefits of Face-to-face meetings. Share of TopScenarios is higher for real team meetings.

- H3. Higher performance of more experienced reviewers in F2F meetings compared to TS meetings
  - Results showed a comparable qualification (based on experience questionnaire) and no significant differences of team scenario brainstorming performance.

  → Future work is
  (a) to modify the qualification assessment to enable more selective results and
  (b) to investigate the impact of experience on nominal team scenario profiles

Thank you ...

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