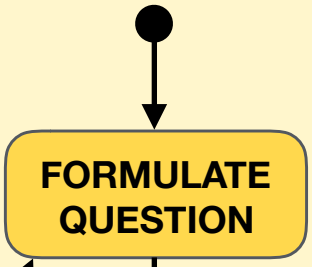


DESCRIPTION

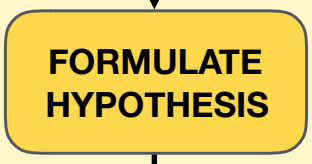
- Contains **technology** in a **context** showing an **effect**.

GUIDELINES

- Create question using a structured approach such as PICOT[1].
- Validate question with FINER[1].

CHECKLIST

- [ ] Question systematically constructed
- [ ] Question's formulation validated



DESCRIPTION

- A testable prediction based on the question.

GUIDELINES

- Contains: two or more variables, context, relationship between the variables
- *'If I [do X], then [Y] will happen.'*[2]

CHECKLIST

- [ ] Hypothesis is formulated as prediction
- [ ] Prediction is testable

DESCRIPTION

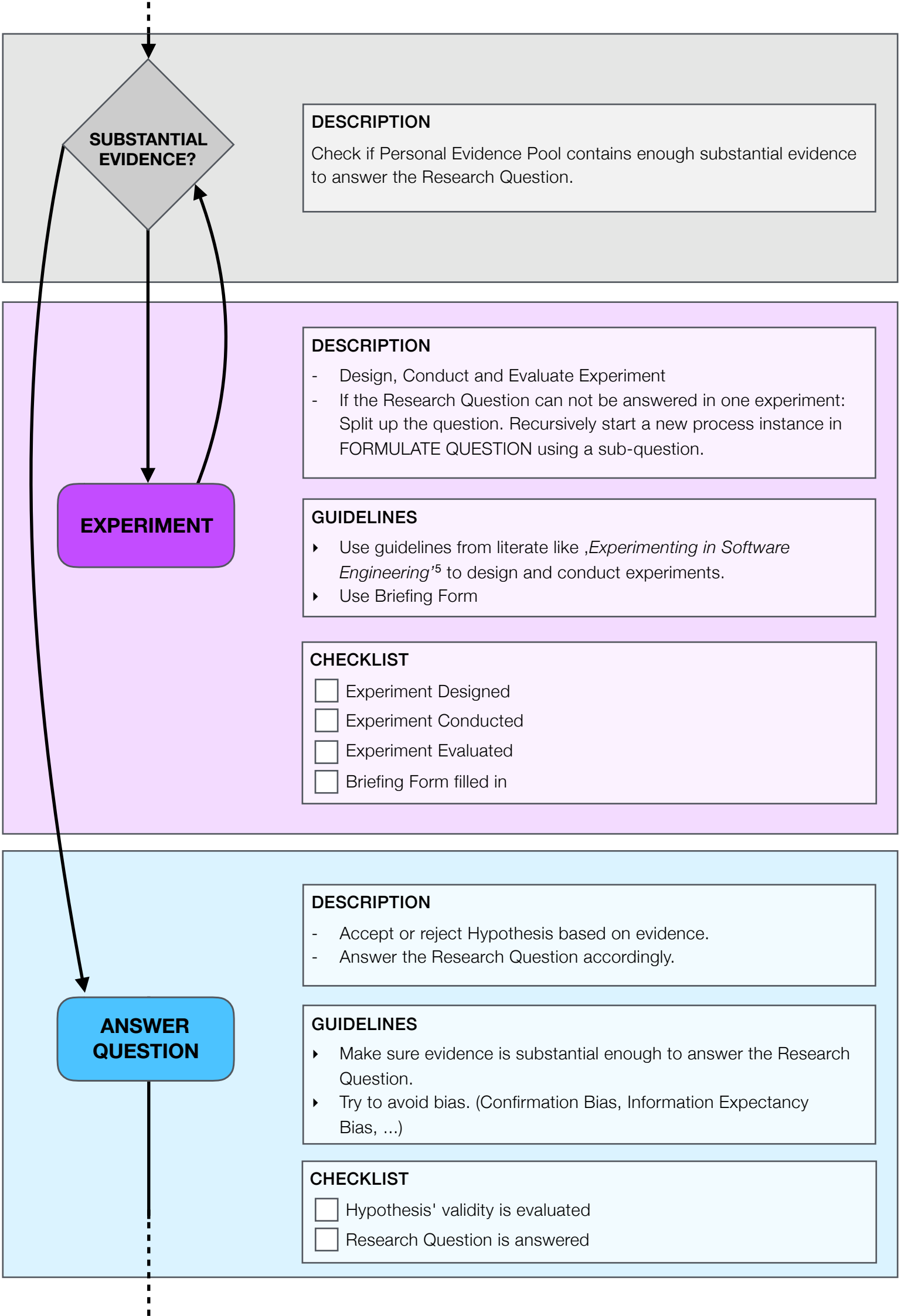
- Search for evidence related to the research question.
- Enlarge your Personal Evidence Pool.
- Deepen your understanding of the research domain.
- If necessary, incrementally refine the research question.

GUIDELINES

- Try to find as much relevant evidence as possible
- Use 'Cited by' function of search engines
- Read through found work's bibliography
- Refer to Systematic Literature Reviews for a wide comparison of related work
- Find similar work using classification systems such as CCS[3]
- Use Checklist[4] for critical appraisal of related work
- Note search strings for more structured search approach
- Too few search results? Make Research Question more general
- Too many/general search results? Narrow down Research Question

CHECKLIST

- [ ] Rough understanding/overview
- [ ] Deep understanding
- [ ] Critical appraisal of relevant related work


SUBSTANTIAL EVIDENCE?
DESCRIPTION
Check if Personal Evidence Pool contains enough substantial evidence to answer the Research Question.
EXPERIMENT
DESCRIPTION
- Design, Conduct and Evaluate Experiment
- If the Research Question can not be answered in one experiment: Split up the question. Recursively start a new process instance in FORMULATE QUESTION using a sub-question.
GUIDELINES
- Use guidelines from literate like ‚Experimenting in Software Engineering'[5] to design and conduct experiments.
- Use Briefing Form
CHECKLIST
Experiment Designed
Experiment Conducted
Experiment Evaluated
Briefing Form filled in
ANSWER QUESTION
DESCRIPTION
- Accept or reject Hypothesis based on evidence.
- Answer the Research Question accordingly.
GUIDELINES
- Make sure evidence is substantial enough to answer the Research Question.
- Try to avoid bias. (Confirmation Bias, Information Expectancy Bias, ...)
CHECKLIST
Hypothesis' validity is evaluated
Research Question is answered

DESCRIPTION

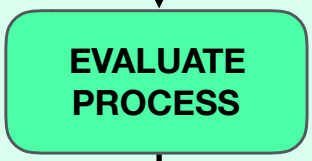
- Discuss the whole study, suggest future approaches and limits.

GUIDELINES

- Critically assess study using EBSE checklist[4]
- Put study in relation to larger context.

CHECKLIST

- [ ] Content of study critically assessed
- [ ] Study put in larger context



DESCRIPTION

- Reflect on your work in the previous steps and seek ways to improve your future performance.

GUIDELINES

- Use After Action Review and Postmortem Analysis[4]

CHECKLIST

- [ ] AAR done
- [ ] PMA done
- [ ] Conclusions drawn for future processes

QUELLEN

[1] *Farrugia, P., Petrisor, B.A., Farrokhyar, F., Bhandari, M.: Practical tips for surgical research: Research questions, hypotheses and objectives. Canadian journal of surgery. Journal canadien de chirurgie 53(4), 278–281 (2009)*

[2] *Buddies,S.:A Strong Hypothesis (2010), http://www.sciencebuddies.org/blog/ 2010/02/a-strong-hypothesis.php*

[3] *http://dl.acm.org/ccs/ccs.cfm*

[4] *Dybå, T., Kitchenham, B.A., Jorgensen, M.: Evidence-based software engineering for practitioners. IEEE Software 22(1), 58–65 (2005)*

[5] *Wohlin, C., Runeson, P., Höst, M., Ohlsson, M. C., Regnell, B., & Wesslén, A. (2012). Experimentation in software engineering. Springer Science & Business Media.*

Population	What specific population are you interested in?
Intervention (Technology)	What is the investigational technology/ intervention?
Comparison Group	What is the main alternative/ baseline to compare with the intervention
Outcome	What do you intend to accomplish, measure, improve or affect?
Time	What is the appropriate follow-up time to assess outcome?

Feasible	▸ Adequate number of subjects ▸ Adequate technical expertise ▸ Affordable in time and money ▸ Manageable in scope
Interesting	▸ Getting the answer intrigues investigator, peers and community
Novel	▸ Confirms, refutes or extends previous findings
Ethical	▸ Amendable to a study that institutional review board will approve
Relevant	▸ To scientific knowledge ▸ To clinical and health policy ▸ To future research

Study Appraisal Checklist

1. Is there any vested interest?
   - Who sponsored the study?
   - Do the researchers have any vested interest in the results?
2. Is the evidence valid?
   - Was the study's design appropriate to answer the question?
   - How were the tasks, subjects, and setting selected?
   - What data was collected, and what were the methods for collecting the data?
   - Which methods of data analysis were used, and were they appropriate?
3. Is the evidence important?
   - What were the study's results?
   - Are the results credible, and, if so, how accurate are they?
   - What conclusions were drawn, and are they justified by the results?
   - Are the results of practical and statistical significance?
4. Can the evidence be used in practice?
   - Are the study's findings transferable to other industrial settings?
   - Did the study evaluate all the important outcome measures?
   - Does the study provide guidelines for practice based on the results?
   - Are the guidelines well described and easy to use?
   - Will the benefits of using the guidelines outweigh the costs?
5. Is the evidence in this study consistent with the evidence in other available studies?
   - Are there good reasons for any apparent inconsistencies?
   - Have the reasons for any disagreements been investigated?

After Action Review (AAR)

- What was supposed to happen?
- What actually happened?
- Why were there differences?
- What did we learn?

Postmortem Analysis (PA)

- What went so well that we want to repeat it?
- What was useful but could have gone better?
- What were the mistakes that we want to avoid for the future?
- What were the reasons for the success or mistakes?

QUELLEN

FINER, PICOT: *Farrugia, P., Petrisor, B.A., Farrokhyar, F., Bhandari, M.: Practical tips for surgical research: Research questions, hypotheses and objectives. Canadian journal of surgery. Journal canadien de chirurgie 53(4), 278–281 (2009)*

Checklist, AAR, PA: *Dybå, T., Kitchenham, B.A., Jorgensen, M.: Evidence-based software engineering for practitioners. IEEE Software 22(1), 58–65 (2005)*