Research

with a perspective on research in Software Engineering

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Why is research a good thing to happen to you?!

There was a conversation between me and my student about this talk to be given to you, during which he suggested that I should talk about this point!

So, here you go.
Make your observations

Your outlook moves towards better understanding

you are uncomfortable when a concept that you are dealing with is not clear to you

Your thinking becomes sharper and clearer

you learn to observe

you also avoid vague, and incorrect statements

You orient yourselves to think objectively

your results are verifiable and reproducible by others.

opinions are identified as opinions.

facts is what research is all about

opinions drive the research for facts

The facts that come out of research is a totally new knowledge to you

if it isn't, then it's not research for you. Something I already know is only reminded of, not researched.

but acceptance by community requires that it is research for the community

What happens when you send your work for publication in a community: if the facts researched by you are new for the community, and the community finds them worth publishing in that community, your paper gets accepted by that community

The output of Research is always a mental concept which can be written on paper

anyone can write anything about anything, and hence the question of validation of your research becomes very important in the scientific method of research

Scientific Method of Research How are findings of research validated?

mathematical proofs

logical reasoning

statistical reasoning coupled with experimental analysis or a simulation claimed only as a simulation

proof by construction

***Application** is solving a problem by applying known knowledge*

application is first a mental process of problem solving which can be jotted down on a paper. For example, we have solved various problems of trigonometry, lenses, mechanics, thermodynamics, electrical circuits etc. on paper

Mental application written down on paper can then become a model of its physical counterpart, which can be built physically. This involves engineering processes.

***Development** always has a product in sight. To develop something, one requires application of some known knowledge, and one may also require research to produce new knowledge to address something totally new in the development.*

Components of a Paper Publication

Title – be very very specific

Abstract – what the paper contains

Introduction – what was the need, what was missing?

Sections on Related Work – who else worked on similar problems, what did they do, and what's missing – prove each of your counterpoints

Sections describing your contribution– what,how,why..

Sections on Analysis and Validation – proof of the theory, limitations of your work

Conclusions – you have done all that, but so what?

References – complete list

Acknowledgements – whose help you took

Some Dimensions in Research challenges in the field of SE

Processes *Mechanisms* *Tools*

Support *Products* *Teams*

Forward *Reverse* *Refactor*

Education

Specify *Analyze* *Design*

Develop *Test* *Maintain*

Languages *Methodologies* *Standards* *Documents*

Formalisms *Pictures* *Implementations*

Functional *Non-functional*

Experimental *Statistical* *Logically Reasoned*