Dr. Norbert Cheung's Lecture Series

Level 5 Topic no: 42

Research Report and Presentation (part 2)

Contents

Reference

Engineering Research: Design Methods and Publication, Herman Tang, Wiley, 2021.

1. Development of Research Report

Process of Write-ups

#1 Writing Sequence

Researchers have different preferences of where to start writing. Interestingly, a writing process should not be in sectional sequence. According to the practice of many experienced researchers, we start the core elements (i.e. Problem, Methods, Results, and Discussion) first. After drafting core elements, we can work on the three key elements (that is, Title, Abstract, and Conclusion), often the conclusion section first. We then work on remaining supporting elements. In general, we should revise all sections several times. Figure 8.10 shows a recommended report preparation sequence. Readers may try it and see if it improves your writing effectiveness.

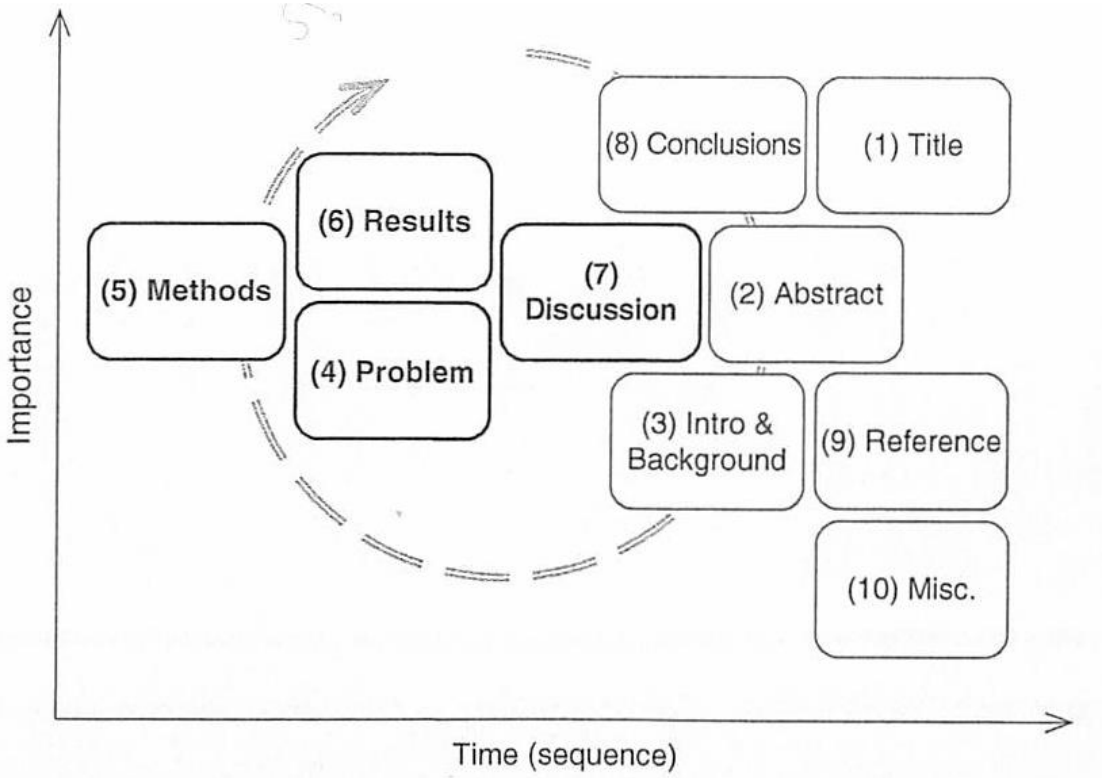

Figure 8.10 A recommended writing process.

The first effort to start writing can be the *(5) Methods* section, which is mostly derived from the initial research proposal. If there is no significant change from

the proposal, the methods section may look similar and with added details and updates from the research work.

Then, we can summarize the outcomes of our work and write the *(6) Results* section. With the methods and results, we are in a better place to update the *(4) Problem Statement* section, which is similar to that in the original proposal. Then, we develop the *(7) Discussion* section based on the results and our thoughts and interpretation. As discussed earlier, many researchers like to combine Results and Discussion into one section.

With a draft of the core sections above, we can go into the key elements: the sections *(8) Conclusion, (2) Abstract,* and *(1) Title.* In other words, we take care of the report title and abstract in the end to reflect the revised research outcomes and discussion.

#2 The Final Report

When the research is near completion, we may start writing with accumulated research materials. In addition, we need reasonable time for possible additional work. As a process, writing should be integrated into the research process instead of a standalone task at the end. It is better to keep thinking about the final report

#3 Update and Revision

The final report should go through multiple iterations of updates and revisions, including by authors themselves and based on the feedback from advisor and colleagues. Some experienced researchers suggest at least five iterations of revision.

We may consider four tasks in the sequence of revising below:

1. On the overall report flow, structure, and headings
2. On the data, methods, and figures
3. On the conclusion, abstract, and title
4. On the wording and grammar

Whenever possible, we should seek feedback from others and revise our manuscript accordingly. We may request others to address the four tasks mentioned above and seek for their input. In addition, during drafting and revision,

#4 Writing Format – Styles

Many scholarly journals have their own format requirements, which are similar with one of the common formats. There are also variations of the format requirements in different disciplines and journals. Thus, it is wise to know the appropriate style when starting to write a manuscript to avoid later make-up efforts for formatting.

#5 Writing Format – Headings

The headings of sections and subsections should be brief and specific. In most cases, we use two to four words for headings. In addition to being concise, the length of all headings should also be balanced, spanning a report and paper. For example, it seems unbalanced if most headings are three words and one heading is six-word long. During the final revision process, headings should be reviewed again and revised as necessary.

#6 Writing Format – Sections

In most cases, each section may have a summary by itself. It is often an issue where the transition from one section to the next is abrupt and the overall flow of a paper is not smooth. The transition between sections and between subsections can be a focus in report revision.

#7 Writing Format – Figures and Tables

When preparing figures and tables, we need to keep in mind of a few points to make figure and table presentation effective:

- The captions of figures and tables should be self-explanatory, so readers do not have to read the context to understand the figures and tables.
- Every figure must be referenced in the main body of the text. In other words, an explanation is required for each figure and table.
- Figures and graphics may be generated using the figure functions of software, such as Microsoft Excel and PowerPoint.
- Color figures should have distinguished legends in terms of shape and size, such as *, +, ×, •, ¤, and Δ, which is important as the publication may be printed and copied in black and white.
- If a couple of figures are to be compared, they should be designed using the same scale.

#8 Writing Format – Equations

Equations are an integral part in many technical reports. It is a common practice using the Microsoft Equation function, embedded in MS Word and PowerPoint, for equation creation and formatting. Google Docs has similar functions. In a Microsoft Word setting, the font settings in the equation function and in the text are separately determined.

#9 References to good writing

- Writing Research Papers (www.dgp.toronto.edu/~hertzman/advice/writing-technical-papers.pdf) (Hertzmann n.d.)
- How to Write a Great Research Paper (https://www.microsoft.com/en-us/research/academic-program/write-great-research-paper/) (Jones n.d.)
- Basic Steps To Write An Outstanding Research Paper (https://collegepuzzle.stanford.edu/basic-steps-to-write-an-outstanding-research-paper/) (Wilson 2017)
- Keys to Designing Effective Writing and Research Assignments (www.jsums.edu/academicaffairs/files/2012/08/Keys-to-Designing-Effective-Writing-and-Research-Assignments.pdf?x19771) (Weimer n.d.)

#10 Statements and Limitations

As discussed, it is applaudable and beneficial that we acknowledge the limitations and/or weaknesses of our research in a report. Based on the objectives, assumptions, and resources of a research project, we may discuss a validated scope of research. We can also consider possible implications of the results for future studies as a visionary recommendation rather than a conclusion. We can discuss the uncertain meanings of research results and possible influences by known and unknown factors on the results as well. By reading such discussions, readers can better know how far our research effort and results may extend.

In most cases of technical writing, we should avoid subjective statements and overestimated contribution as they may result in reader's dislike.

#11 Conciseness and Wording

Academic writing and presentation should be clear and simple, do not overwhelm readers with needless complex words. We carefully select jargon based on audience. In most cases, simple words are preferred. Table 8.2 lists a few examples.

To be concise, two words are not preferred when one word can work for the same purpose. In some cases, spoken English uses more words than written English. Table 8.3 lists several examples, not a complete list, for the hints to readers.

Contractions, such as "it's" and "weren't," are not used preferably in technical and professional writing. Another suggestion is not to use "to be" words, such as "was," "were," and "has been" too many times. Instead, try to use active verbs as they may speak powerfully.

We would also suggest using neutral (nondirectional) language in most places of a technical report. Here are a few examples:

- Concerning the data reliability in conclusions, we may use phrases like "it seems that…", "it is likely that…", "one leads to believe that…"
- Talking about a fact, we may use the phrases "Evidence indicates…" rather than "Everyone agrees…"
- For a remaining disagreement, we can say, "Some would argue/contend the point…"

Table 8.2 Examples of considering simple words.

Complex word	Simple word
Apprise	Inform
Aforementioned	Mentioned
Endeavor	Try
Heretofore	Previous
Individualized	Individual
Modicum	A small quantity
Utilize	Use

Table 8.3 Examples of considering concise phrases.

Redundant word	Concise word
Already existing	Existing
At the present time	At present
Completely eliminate	Eliminate
Different entities	Entities
Due to the fact that	Because or since
Had completed previously	Had completed
Introduce a new	Introduce
Make a decision	Decide
Mix together	Mix
Period of time	Period

Table 8.4 Examples of word selection for research statements.

Preferred	Questionable	Example: usage in sentence
Few	None	_____ of subjects has been investigated.
Rarely	Never	The characteristics are _____ addressed.
Often	Always	The data _____ support the principle.
Most	All	_____ research on this topic agrees…

Strong words, such as "prove," may not be appropriate in the conclusions for most applied research and R&D. With limited resources and efforts, it can be challengeable if we claim something is "proven." There have been discussions on in what conditions "prove" or "proven" may be used in research conclusions (Cooper 2016), but no widely accepted criteria. However, "prove" may be good for some basic research and theoretical analysis.

#12 Other Tips

Some researchers prefer writing in an impersonal style. For example, authors use the passive voice to show the facts in technical papers and sound objective. In general, the excessive use of personal nouns, such as I and me, may lead readers to feel the study result was subjective.

Here are some additional tips:

- Using altered expressions when appropriate for the same meaning, such as "This analysis provides…," "The paper analyzes…," and "This paper presents an analysis of…" is suggested.
- Transition words, such as "accordingly," "by comparison," "equivalently," and "on the contrary," can make a paper smooth for reading comprehension.
- To make reading easier, subjects should sometimes be repeatedly used in sentences instead of using their pronouns. It may be difficult to identify the antecedent when using "it" or "this" where there are several subjects in a paragraph.

2. Research Presentation

#1 Attending Conferences

Attending technical conferences is a common professional exercise for both experienced and novice researchers. First, we have opportunities to learn the latest updates and to meet new colleagues by attending conferences. Moreover, many people consider conferences a good professional networking platform and an opportunity to find a new job. In addition to learning from others, we also can present our research findings at a conference. Compared to written reports and papers, an oral presentation is an interactive learning opportunity with other professionals from the world. Many conferences also have a poster session.

#2 Presentation and Keynote

The aim of a research presentation is somewhat different from general technical presentations. The former is to report detailed research work and findings, while the latter is for lecturing and insight sharing. Figure 8.11 shows typical presentation examples: (a) research work and (b) a keynote speech on a similar subject at a professional conference.

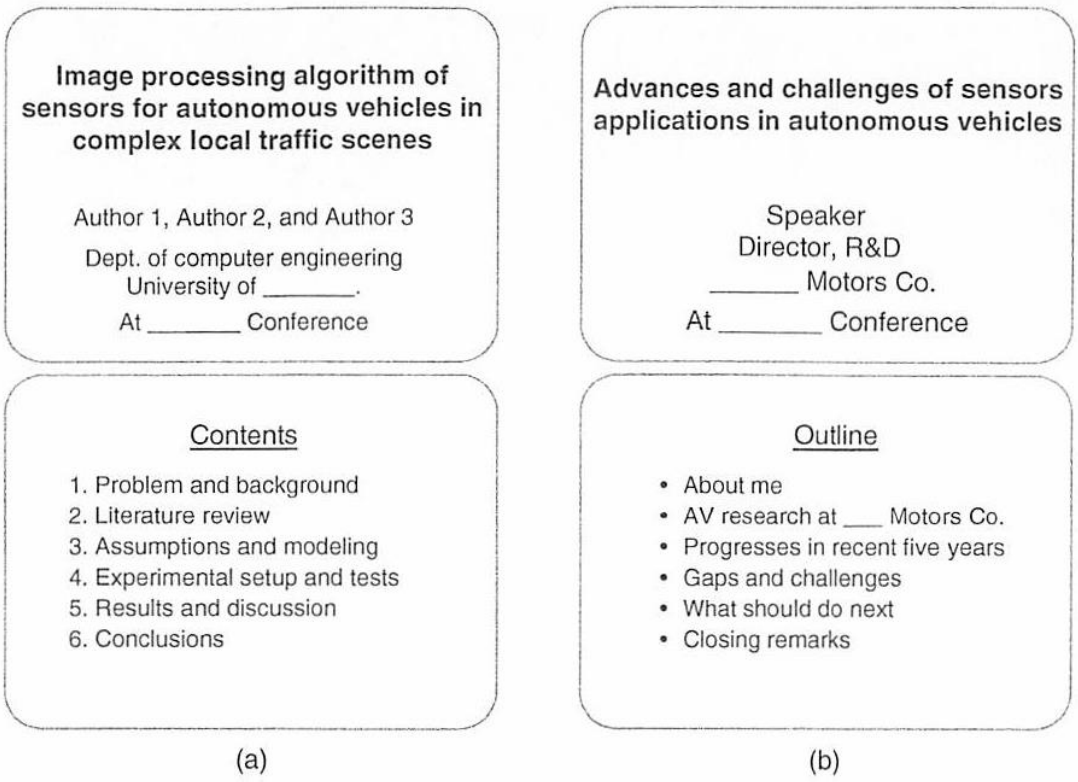

Figure 8.11 Research presentation vs. keynote speech. (a) Research presentation. (b) Keynote speech.

#3 Poster Presentation

A major difference between a poster and oral presentation is the design. For example, the poster's shape and size are generally limited to one large page or tri-fold display design in size of A0 (841 mm × 1189 mm) and need to put all information into an available space. Conference organizers often provide a template for the layout of posters, referring to Figure 8.12 as an example. The font sizes and format are recommended in a poster template.

We have a few recommendations for a poster design:

- More graphics and less text
- Readable size of fonts from one meter away
- Using colors if possible
- Leaving appropriate empty space overall

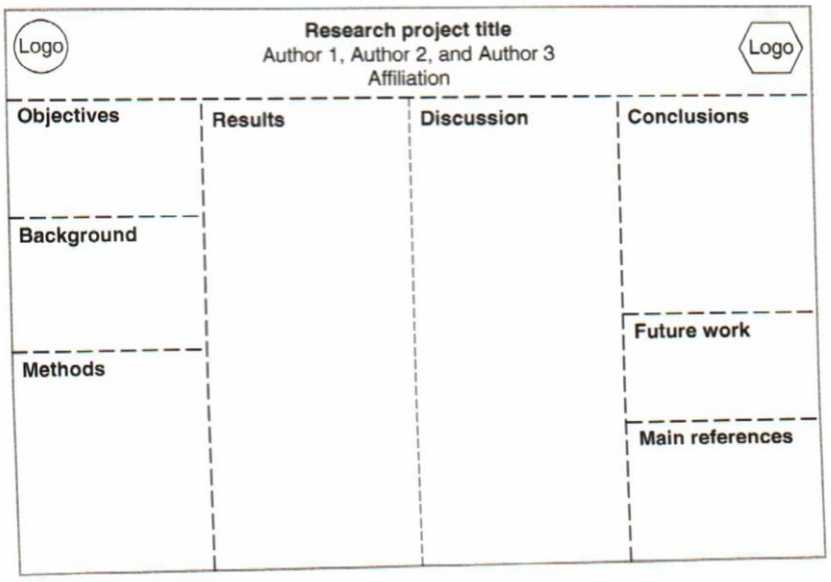

Figure 8.12 An example of poster layout.

#4 Presentation Design – number of slides

Number of slides: 1.5 – 2 min per slide. 12-16 slides for 20 min talk.

Table 8.6 A recommended presentation file planning.

Section	Number of slides
Cover (title, name, and affiliation)	1
Outline	1
Introduction and lit review	1–3
Data, experiment, or model	3–4
Analysis and discussion	3–4
Conclusion (or summary)	1
Reference	1
Thank you and Q&A	1

#5 *Slide Layout*

A presentation audience not only listens the presenter but also reads the slide show on a projector screen. Therefore, the layout design of presentation slides should be friendly to the audience. Accordingly, the font size of context should be large enough, say at least 20-point. If there is no room for a large font size, it may tell us that there are too many details on one slide. The content should be either simplified or extended to two slides. The graphics should be large as well, including the smaller letters in a graphic. Figure 8.13 shows an example of presentation layout design.

Presentation slides should be as self-explanatory as possible, which is beneficial not only for an effective verbal presentation but also for file distribution later. During and after a conference, some attendees may contact a presenter and say, "Sorry, I missed your presentation but am very interested in your study. Can you just share with me your presentation file?" A well-designed, self-explanatory presentation file can lead to more interest and a further discussion.

During a presentation, a presenter should not read the contents of a slide. Rather, a presenter should use slides as a reminder of what to say and supporting facts and evidence. Therefore, do not put too many words in a slide, aiming for about 50 words or fewer.

In addition, most technical professionals use simple backgrounds, rather than the fancy color schemes, to avoid becoming distractive or difficult to read. It is also a good idea that each slide has a plenty of "white space" rather than being full of contents. Often, the organizers of a professional conference suggest a template for the preparation files. Figure 8.14a,b show an example of a presentation.

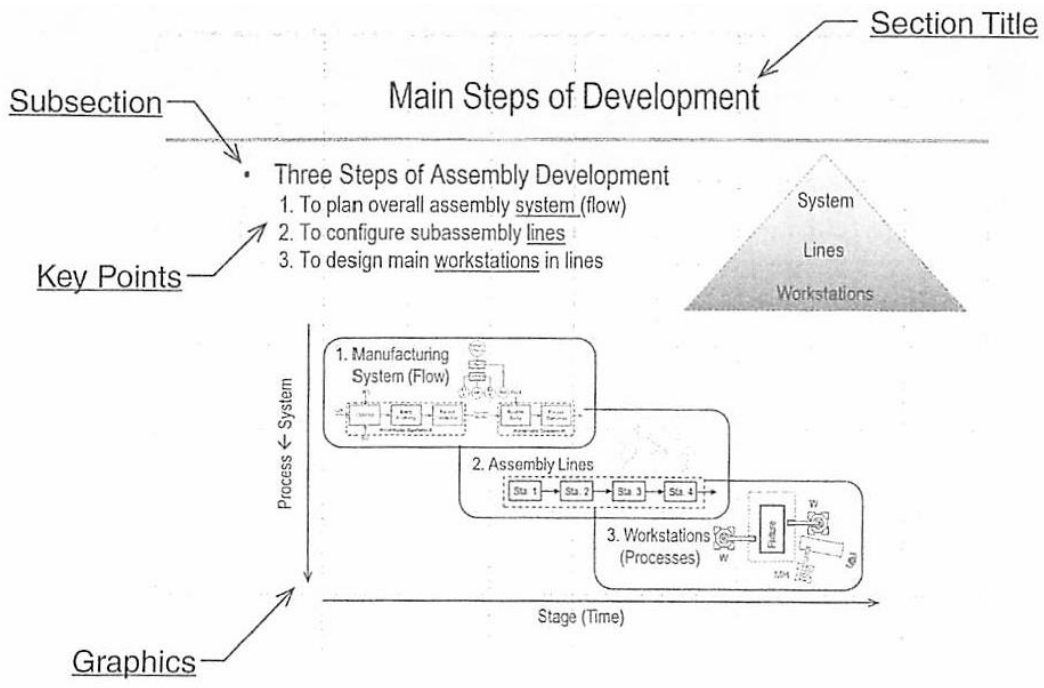

Figure 8.13 An example of presentation slide design.

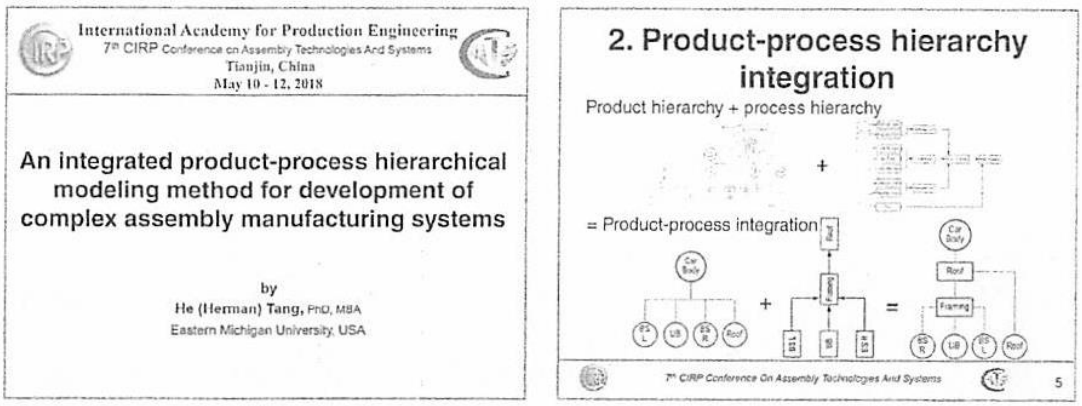

Figure 8.14 An example of presentation in a template. (a) Cover slide. (b) Content slide.

#6 Graphics and Fonts

To show data and information, we consider the commonly used graphics:

- Pie Charts: To show percentages and comparisons if multiple pie charts used.
- Bar Graphs: Good to illustrate relative amounts, may be more obvious than line charts.
- Line Charts: Appropriate to demonstrate continuous changes and patterns; and to illustrate the interactions if multiple lines in a chart.
- Scatterplots: For a large amount of data to show individual points rather than lines or bars.
- Statistical charts, such as control charts, box-and-whisker plot, etc. Depending on the target audience, a certain level of explanation is necessary.

We follow some rules:

- Graphics and pictures should be in a high resolution with an appropriate contrast.
- Certain text letters or phases may be colored for emphasis.
- Colors and context in the graphics should be kept simple.

#7 Practicing for Overall Flow

Presenting a research project is like telling a story: we need a logical flow to convey key points clearly and concisely. It is important to keep in mind who our audience are and what they are most interested. In most cases, they are professionals in the same fields. Therefore, presenters can know the professionals' background, expectations, and possible questions and develop a presentation accordingly, focusing on main achievements and preparing for possible questions.

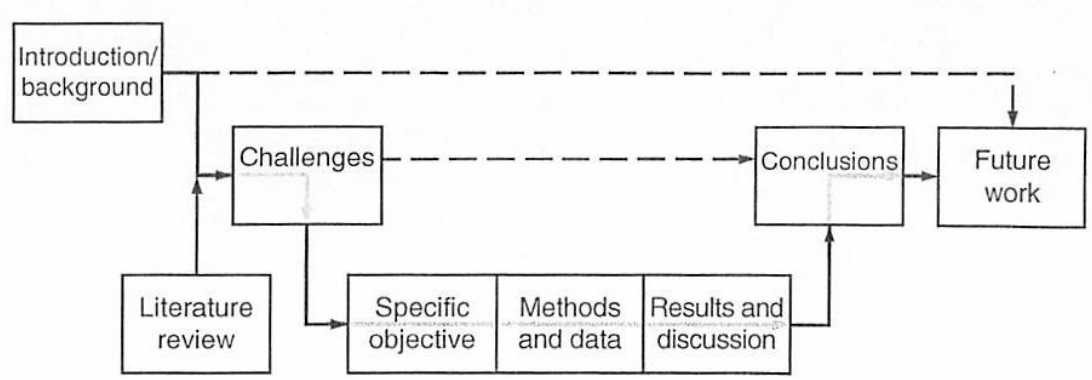

Figure 8.15 Section connection and flow of research presentation.

Before reporting our specific research, we start with a big picture – interesting and worthwhile research efforts. Then, we introduce what challenging barriers were to the big picture based on literature review (and our insight). When closing, we state what we have contributed to the challenges and what future directions are in the big picture.

#8 Professional Presenting

During a presentation, we should have good eye contact with the audience. In addition, we keep our eyes uniformly around the entire audience, rather than staying on any particular person. As a formal presentation, common word fillers in daily spoken English, such as "well," "you know," and "I mean," should be avoided as well.

#9 Q and A section

During a presentation, experienced audiences may ask challenging questions. If we do not immediately know the answer to a question, we may say something like, "Thank you for the question. I actually don't know the answer at this moment, but I will look into it and get back to you." After a presentation, we should make connections with interested audience members and follow up with them after the conference.

When discussing with an audience, we should avoid coming across as argumentative or overly defensive. We can state we had different considerations and understanding, which is considered impolite. However, it is inappropriate that a presenter argues with an audience member regardless of who is correct. We may arrange a healthy discussion and detailed explanation after the presentation section or after the conference.

#10 Student Project Presentation

In addition to oral presentation and posters, student's projects can be presented in the form of artifacts, which is a common practice for the R&D projects of undergraduate students. The artifacts show student's inventions. Besides the

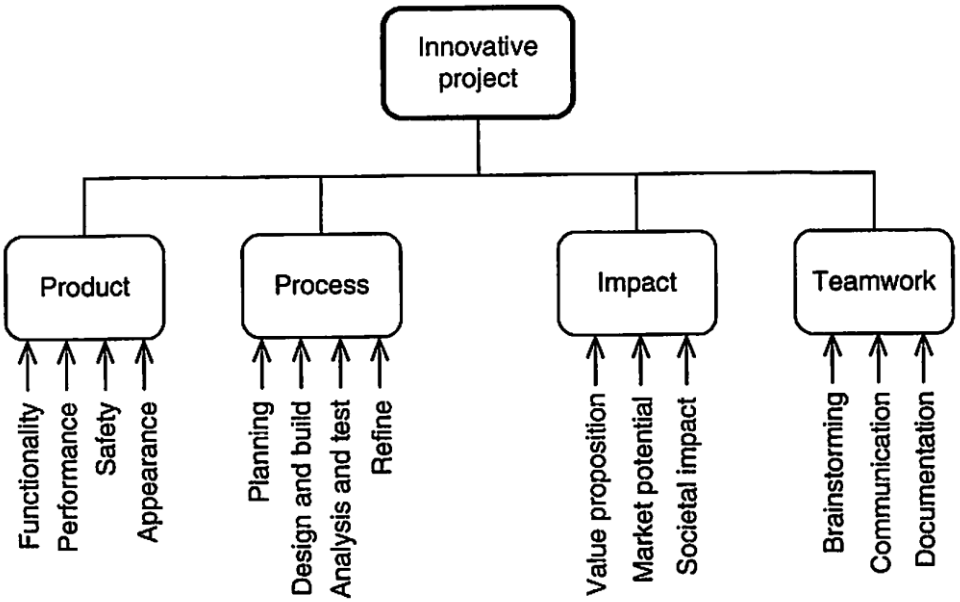

Figure 8.16 Evaluation factors of student invention projects.

preparation work similar to posters, students keep the project judging criteria and rate weights, which vary significantly with projects, when preparing a project presentation. Figure 8.16 lists the common factors of project evaluation as a reference.

3. Summary

Introduction to Academic Writing

1. The main requirements for academic writing include objectiveness, direct, descriptiveness, clarity, and certain formatting.
2. The structures of master's thesis and doctoral dissertation are in a similar format but different in length. University graduate schools normally have detailed format requirements.
3. Research articles have different types, categorized and viewed in terms of technical details and writing formality.
4. Technical reports and scholarly papers have similar contents but different features and focuses.

Elements of Report and Thesis

5. All the elements of research articles can be categorized into key, core, and supporting parts.
6. The key elements are title, summary/abstract, and conclusions. The core elements are problem statement, method, results, and discussion. The supporting parts of a research article include introduction, reference, and optional acknowledgement, appendix, etc.
7. The title of a research article is normally 10–15 word long.
8. The summary or abstract of a research article addresses problem statement, method and data, and outcomes.
9. The problem statement of a research article can be one sentence, paragraph, or section; preferably in a straight and concise manner.
10. The method section of a research article should be specific, with appropriate detailed information.
11. The result and discussion sections of a research article may be either combined or separated.
12. The conclusion section of a research article briefly reports research results and findings, including contributions, limitations, and future work.

Development of Research Report

13. The writing sequence of a research article differs from the order of article sections. Some core elements (method, results, and problem statement) are developed first. While, the key elements (title, summary/abstract, and conclusions) are composted later.
14. Research articles should be in a professional fashion and language, different from non-technical writing and oral style, following certain formats.
15. There are often requirements and recommendations for the format, sectional structure, sectional headings, figures, etc. of research writing.
16. Wording, voice, and style are also important, following professional practices.

Research Presentation

17. Presentations at professional conferences are beneficial for exchanging ideas and networking.
18. Attending a conference incurs costs of registration, travel, lodging, etc.
19. The number of presentation slides depends on the given presentation time, about 1.5 minutes a slide on average.
20. There are some recommendations for presentation design and oral preparation.

----- END OF PART 1-----