

Chapter 2

Technical and Cognitive Skills in the Context of Scientific Writing

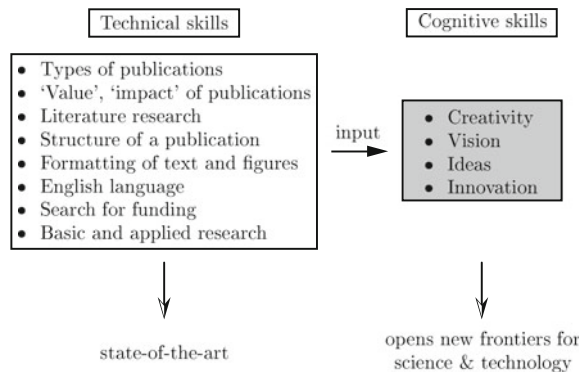
Abstract This chapter summarizes briefly factors and skills which influence the success in scientific, technical & medical publishing. Two groups are distinguished whereof factors and skills from the first group, the so-called technical skills, can be more or less easily acquired within the scope of short courses, workshops or by studying the respective literature. Factors from the second group, the so-called cognitive skills, are influenced by socioeconomic, individual and work environment factors and cannot be achieved in a short time. To acquire these skills, at least to some extent, long-term strategic planning is necessary.

Keywords Technical skills • Cognitive skills • Creativity • Ideas • Innovation

2.1 Technical and Cognitive Skills

Scientific, technical & medical publishing requires certain skills in order to crown the efforts with success, this means that a manuscript is accepted for publication. Some of these skills are not so difficult to acquire and this book is intended to make a contribution to spread this knowledge, e.g. by recommendation on how to prepare a manuscript. Other skills, however, are difficult to learn or to master, or are even partly out of the influence of the novice in the writing business. The distinction between technical and cognitive skills is shown in Fig. 2.1. Technical skills refer to the knowledge about the different types of publications in the context of journal and book publishing, how to find scientific publications, their assessment in terms of ‘value’ or ‘impact’, possible ways of acquiring funding and the difference between fundamental and applied research. Furthermore, skills which are directly connected to the preparation of a manuscript such as its structure, formatting text and figures and sufficient English language skills. All these skills have in common that they can be ‘learned’ in quite a short time, possibly through seminars, courses, workshops or any other form of direct instruction. Cognitive skills refer to the ability of being

Fig. 2.1 Technical and cognitive skills in the context of scientific, technical & medical publishing



creative and innovative, and having ideas and visions. It is quite logic that such skills cannot be so easily acquired in any course or workshop as technical skills. Some people have a natural ability to be creative and are predestined due to this ‘gift’ to develop new ideas and products. Nevertheless, cognitive skills can be developed and influenced—at least to some extend—in a long term process. Knowing the factors which influence and develop cognitive skill is an important background for decision takers to provide the right environment.

It should be noted here that the technical skills can serve to get an overview on the actual research or trends and to analyze what has been done in a certain research field up to now. However, ‘digesting’ this knowledge and creating new visions and ideas for science and technology is mainly governed by cognitive skills.

Let us say, finally, that the idea of cognitive and technical skills in the publishing context is inspired by the research on ‘human inequality’ where the ‘cognitive ability’ and ‘noncognitive abilities’ are distinguished [1, 2]. Within this research direction, the importance of both types of abilities on health, productivity in the labor market and performance in society is discussed in many scientific publications, e.g. [3, 4].

2.2 Factors Influencing Creativity

Stimulating and developing creativity is a difficult task. In the academic field, a very important time for a young researcher is the time when conducting the PhD research work. This time is normally quite different to the school-like education on the BSc and MSc level. A young scientist is exposed for many years to a research topic and he or she must proof to be able to master the research work. Very influencing is of course the research group and work environment and the PhD candidate may check in advance how active his future supervisor and research group is. The internet with its scientific databases (see Chap. 5) can easily serve to check how productive a researcher or group is. Of course that ‘productivity’—in the sense of scientific output

in the form of publications—is not equal to ‘creativity’ but under circumstances a good indicator for it.

Furthermore, it should be considered how a PhD work is supposed to be conducted. Two major concepts are nowadays found in the academic landscape [5]. The first concept is more a school-like approach where the ‘route’ is more or less sketched right from the beginning (so-called structured PhD program). A clear project schedule is given for the entire project¹ and well-defined milestones allow to monitor the progress of the research work. The primary advantage for the PhD candidate is definitely that contents and approaches are more or less known and the entire time for performing the research should not deviate too much from the scheduled period. The second approach for a PhD project is based only on the *principal idea* which is given to the candidate (so-called individual PhD program). It is then the task of the student to evaluate the best approaches and ways to solve the given tasks. The interaction with the supervisor and the entire research team is here important to evaluate and select the right approaches. It is obvious that such an approach may be quite iterative and time consuming but definitely ‘forces’ the development of cognitive skills. Or in other words, the second approach is only possible to master if cognitive skills are developed or being developed during the research work. Further strengths and weaknesses of both models can be found in [9].

Classical work environment factors which affect creativity are listed and commented in Table 2.1. Many of these factors apply to the academic and industrial research sector. For industrial series production however, many of the factors can or even must be excluded. In the academic context, ‘autonomy or freedom’ is considered as a high valuable good and distinguishes most from many organizational schemes in industry. At many universities, formal issues step back (this may be manifested, for example, in a free dress code or in the way the academic staff addresses each other) and the most important attitude is the creation of new ideas and constructive academic dispute.

In addition to the above mentioned factors, creative thinking is highly affected by socioeconomic and individual factors, see Table 2.2. Such factors are the result of the education [10] and experiences someone went through. Logically, these factors are the result of long term processes and are difficult to establish. Looking at ‘education’ it should be mentioned here that gaining knowledge is the important task and that obtained marks are not necessarily equal to knowledge.² In the academic sector, ‘out-of-the-box thinking’, i.e. not to follow the classical and traditional ‘routes’, is highly valued and factors as family background, society structure and attitude, education and exposure to different environments may contribute to stimulate this key ability. It must be also considered here that the academic education (see for example the different levels of academic degrees: BSc → MSc → PhD → DEng, DSc, habil.) should not only be a pure educational process but also a selection process of the creative which will join research for science and technology. Based on the above

¹ On the other hand it may be questioned how it is possible to indicate each step of a new research project or area over a time frame, for example, of three or five years.

² Do we academics achieve our goal if we produce only A+ students?

Table 2.1 Work environment factors affecting creativity

Factor	Comment
Encouragement	<i>Organizational:</i> (a) Clear license to produce unusual, risky but useful ideas; (b) Fair and supportive evaluation of new ideas; (c) Positive motivation by extrinsic rewards (bonus), performance-related realistic evaluation (KPI); (d) Collaborative flow of ideas across the institution and participation in management and decision taking. <i>Supervisory:</i> Open interaction and fair, transparent and supportive evaluation. <i>Work group:</i> Diverse backgrounds of team members, openness to ideas and constructive dispute, team work
Autonomy or freedom	How to organize and conduct work, choice on how to accomplish the assigned tasks, work schedule and working hours
Resources	Sufficiently allocated budget, facilities and equipment
Creative location	Geographical location, facilities, staff canteens and cafeterias (food quality and variety, opening hours), natural light offices
Security and safety	Security of employment (no hire-and-fire mentality), safety and health in the workplace
Pressure	Negative influence by excessive workload pressure, positive effect from urgent, intellectual challenges
Organizational impediments	Swollen bureaucracy, low level of transparency, not being performance-related, not being a supporting unit, internal strife, conservatism, rigid and formal management structures

Partly adapted from [6, 7]

Table 2.2 Socioeconomic and individual factors affecting creativity

Factor	Comment
Education	Gained knowledge and experience
Family	Size, background, atmosphere
Creative-thinking skills	Flexibility, imagination, out-of-the-box thinking
Living environment	Society, location, recreational and leisure activities, low crime rate
Varied background	Exposure to different cultures, work and living environments
Age	Activities against loss of creativity with age
Personality	Self-confidence, many different interests, sound principles, honesty, open mindedness

Partly adapted from [8]

said we may conclude that stimulating creativity is a quite complex process and definitely needs huge efforts and good strategies to be successful.

References

1. Heckman JJ (2007) The economics, technology, and neuroscience of human capability formation. *Proc Natl Acad Sci U S A* 104:13250–13255
2. Cunha F, Heckman JJ (2008) Formulating, identifying and estimating the technology of cognitive and noncognitive skill formation. *J Hum Resour* 43:738–782

3. Heckman JJ (1995) Lessons from the bell curve. *J Polit Econ* 103:1091–1120
4. Heckman JJ (2001) The importance of noncognitive skills: lessons from the GED testing program. *Am Econ Rev* 91:14–149
5. Deutscher Akademischer Austausch Dienst—PhDGermany—FAQ for applicants (2013). <https://www.daad.de/deutschland/promotion/phd/en/14747-phdgermany-faq-for-applicants/>. Cited 12 April 2013
6. Amabile TM, Conti E, Coon H et al (1996) Assessing the work environment for creativity. *Acad Manage J* 39:1154–1184
7. Petron A (2007) Factors affecting creativity in the product design industry. <http://web.mit.edu/petron/Public/creativdesign.pdf>. Cited 17 May 2012
8. Narayana BVL (2012) Factors influencing creativity and innovation—creativity. National Academy of Indian Railways. www.rscbr.indianrailways.gov.in/.../13074468.... Cited 1 September 2012
9. Brox C, Kuhn W (2012) Structured or non-structured doctoral programmes? A bottom-up approach for third-cycle Bologna implementation. In: Seminar proceedings of the 8th European GIS education seminar, 6–9 September 2012, Leuven, Belgium
10. Rehm M (1989) Factors affecting creativity: perspectives from home economics teachers and student teachers. *J Vocat Home Econom Educ* 7:13–27

Introduction to Scientific Publishing

Backgrounds, Concepts, Strategies

Öchsner, A.

2013, XVII, 96 p. 26 illus., 13 illus. in color., Softcover

ISBN: 978-3-642-38645-9