

Chapter # - will be assigned by editors

SEAMLESS WRITING: HOW THE DIGITISATION OF WRITING TRANSFORMS THINKING, COMMUNICATION, AND STUDENT LEARNING

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Abstract: This chapter extends the scope of the term ‘seamless learning’ to include writing as one of the most prominent learning activities in education. The seamless learning concept is used to analyse the ongoing flow of digital innovation with respect to the changing instructional and intellectual positioning of writing in its various contexts. The term ‘seams’ is interpreted as frictions or barriers in the writer’s experience and the concept of ‘seamlessness’ refers to coherence in the practice and learning of writing. In order to understand the impact of digitisation on writing, this chapter recaps on the major development steps of digital writing technology, before offering an example of an integrated learning platform for the writing of academic theses which intends to offer students a seamless writing experience. The results indicate that the term seamlessness in the context of writing should not be directly associated with mobile learning or to the ubiquitous learning opportunities which are qualities that writing technologies have already offered for some time. Other more recent technological changes have provided considerably greater impact on what the authors term as ‘seamless writing’.

Keywords: Writing technology, student writing, digitization, thesis writing, research cycle, learning-to-write

1. INTRODUCTION

Writing is one of the most common learning activities in secondary, higher, and further education. The distinction between *learning-to-write* and *writing-to-learn*, as introduced by Emig (1971), suggests that there are two interrelated

modes of learning. Most kinds of student writing are part of the student's learning assignments (writing to learn) which are used to involve students in some kind of disciplinary learning. However, if students are taught explicitly how to write, then it is considered as *learning to write*. Each writing-to-learn assignment also involves students' learning to understand the rules, conventions, strategies and textual genres, meaning that both modes of writing/learning are usually interconnected.

Even if writing is seen as a singular competence of its own, it is not a uniform activity but differs markedly between disciplines and their diverging epistemologies as contrastive studies have shown (Langer & Appelbee, 1987; Poe, Lerner, & Craig, 2010; Walvoord & McCarthy, 1990). In higher education, writing assignments are highly heterogeneous. Nesi and Gardner (2012) found over one-hundred genres in use for writing assignments at British universities and demonstrated that each genre is connected to a different learning task that fulfils students' knowledge-based functions. Each task requires different skills and is connected to different procedures. Students soon learn that writing differs from task to task, from discipline to discipline, and even from instructor to instructor.

The digital revolution has changed writing and the teaching of writing in several fundamental ways, bringing an end to the technologies first introduced by Gutenberg in the 15th century. Even though writing has always been integral to the 'technologising of the word' (Ong, 1982/2002), the digital age has accelerated that pace of change and has led to several subsequent generations of new writing technologies. Assessing the impact of digital change on writing and writers is difficult; however, as the crucial activities in writing are mental by nature, they are therefore not directly visible. Seams in writing are not only contextual or social in nature, but also cognitive or mental; thus related as much to intellectual challenge than to the organisation of learning.

Seamless learning is a concept reaching back to the pre-digital age with a first definition from Kuh (1996) referring to the untying of learning from such restrictions as the campus situation, curriculum, or the academic content of assignments. A second conceptualisation was tied more closely to digital learning, and in particular to the availability of mobile devices, which seem to offer completely new teaching and learning opportunities. Chan (2015) suggested that seamlessness 'has become an overall concept in describing what technological innovation and impact may bring to education' (p. xiii). This rather broad use of the term refers to the new opportunities that digital learning, including the widespread availability of connected mobile devices, has brought to teaching and the new ways of learning it has introduced. It is, however, an optimistic, constrained view of such technological changes, lacking a skeptical or critical perspective on digitisation. Problems of

technology adoption and acceptance (for a discussion on new learning technologies in higher education, see Gülbahar, Rapp, Kilis, & Sitnikova, 2017; and for writing technologies, see Rapp & Kauf, 2018), resistance to innovation, cognitive impoverishment, new reading problems etc. are outside of the analytic scope of this concept. There seems only one developmental direction in the seamless learning concept running from more to less seams, or their bridging, and from lower to higher seamlessness.

Since the initial definition of seamless learning by Kuh (1996), many definitions of what was known as Mobile Seamless Learning (MSL) (Chan et al., 2006, and a 2015 reflection upon his initial work; the synthesis of Wong & Looi, 2011; and its subsequent refinement by Wong, 2012; and an extensive and thorough account of the genesis of the field and its definitions by Wong 2015) have still not brought about a conclusive definition of the term seam. Furthermore, Wong (2012) asserts that ‘...seamless learning remains to be a loosely posited learning approach and yet-to-be established learning model’ (p. E19). From an analytical perspective, prior to theorising, it should be understood that seam refers to a very broad category of phenomena such as obstacles, frictions, barriers, breaks, gaps, imbalances, disparities, inconsistencies, or discontinuities. It seems fair to assume that seams are unfavourable for learners while seamless learning arrangements, which consequently would be barrier-free, integral, homogeneous, balanced, consistent, or continuous in time (lifelong learning) and space (referring to the different context within which learning takes place) would be more favourable for learning. However, Sharples (2015), who connects seamless learning to Csikszentmihalyi’s (1990) flow experience, challenges this assumption when he says: ‘There is no evidence that providing a continual flow of learning materials will result in effective learning, and the learner should not just stop and start the flow of learning but control and guide it’ (p. 44). On the other hand, it is an unexplored question as to what extent experiencing seams can provide valuable or even necessary learning opportunities leading to a deeper understanding of subjects or problems. Seamlessness (in the sense of a flow-experience) obviously does not in itself guarantee useful learning and it appears wise to use seamlessness as a descriptive category in helping us to understand changes in learning contexts but not as a concept that directs us automatically to more powerful, effective and personally profitable kinds of learning.

One should be aware that bridging or removing seams from one place may just result in the creation of new seams someplace else. Thus, it could be said that there are more favourable or less favourable seams and that it may be justified to remove certain seams whilst creating others. There will never be a context without seams and any form of teaching first has to *produce* seams;

for instance, when teaching students to think as members of their discipline, barriers have to be created to the thinking modes of other disciplines. Similarly, the development of stable learning habits means to create, or become aware of seams such as finding out when to learn, when to relax, when to study individually, when to collaborate, when to socialise, when to play, and when to work. Seamless learning makes teaching more flexible and may better connect it to its context or consider respective affordances but will never make it seamless in the literal sense.

Looking closer at how seamless learning is referred to in the literature, the most important referential point still seems to be the 10-point list of mobile seamless learning (MSL) dimensions by Wong & Looi (2011), defining the spaces where seams may be removed or reduced:

1. Encompassing formal and informal learning
2. Encompassing personal and social learning
3. Across time
4. Across locations
5. Ubiquitous access to learning resources
6. Encompassing physical and digital worlds
7. Combined use of multiple device types (technology)
8. Seamless switching between multiple learning tasks
9. Knowledge synthesis (prior knowledge, new knowledge, multidisciplinary learning)
10. Encompassing multiple pedagogical or learning-activity models (facilitated by teachers)

The list shows where seams in traditional learning may be expected, and where there are borders or barriers that may be transgressed when introducing new learning technologies. If this list were to be applied to the field of writing, only some of the seams may be touched, whereas others may be of lesser relevance. Writing always encompasses formal and informal learning (dimension 1); but it is less the technology that decides this, rather it is the genre and/or situation in which students are asked to write. Personal and social learning (dimension 2), in contrast, may well be influenced by new technologies, as is the case when using forums, learning platforms, document sharing software, chat rooms, text messages etc., where formal and personal modes of writing may be combined in new ways as compared to writing on paper. The time and location (dimensions 3 and 4) where writing takes place may also be influenced by new technologies, but all the way back to the invention of paper and the pen, reading and writing have been ubiquitous and practiced virtually anywhere. A closer look, therefore, has to be taken at which aspects of writing have actually changed with respect to time and space. Ubiquitous access to learning resources (dimension 5) certainly is a key change in digital writing, opening new ways of reading, referencing,

communicating, and collaborating. Encompassing physical and digital worlds (dimension 6) is a seam that seems to be created by the new technologies and seems to deepen the more technology we use. Writing has always encompassed the use of several devices (dimension 7), with writing media such as the pen, paper, typewriters, and the former schoolroom classic, the blackboard and chalk, which was followed by the (non-interactive/smart) whiteboard. Similarly (dimension 8), pre-digital writing always allowed for switching between tasks (writing letters, notes, lists, essays etc.). Finally, writing always functioned as a means of knowledge synthesis (dimension 9) and has been used in many different pedagogical situations as a means of learning (dimension 10), not just one.

Wong and Looi's (2011) list seems to have been generated with classroom teaching at schools in mind, aiming to overcome rather traditional teacher-centred school settings, but not with respect to a fluid learning technology such as writing. It certainly addresses relevant seams for changes in classroom situations but needs to be extended when used to analyse writing technology.

In this chapter, the terms seam and seamless are used in a descriptive way to refer to obstacles and barriers in learning/writing processes or experiences. The concept helps to detect structural problems hidden in the contextual learning arrangements of writers and find pedagogical solutions to situations where new technologies are introduced. As an example, where seams in writing have changed, the successive stages of technological innovation are looked at first before going on to describe *Thesis Writer*, a self-developed learning platform picturing the opportunities that new technologies offer in rearranging the traditional learning field of thesis writing.

2. SEAMS AND THE DEVELOPMENT OF DIGITAL WRITING TECHNOLOGY

Writing has been ubiquitous and its tools mobile long before the digital revolution started. For several centuries, paper, notebooks, pencils, books, and brochures allowed for writing and reading anywhere and at any time. This revolution of literacy started with the invention of the printing press, along with some later innovations in writing technology such as the iron pen, lasting ink, low-cost paper, and new printing formats such as brochures, magazines, periodicals, and paperback books. The first generation of digital tools, in contrast, immobilised writing by tying it to voluminous desktop computers and heavy printers, and thereby made it dependent on the availability of computer hardware at schools and universities. The real revolution of writing

was not in the tools' reduction in physical size or in their added mobility. Word processors and, later, the introduction of the Internet and email were the technological innovations to effect writing sustainably. These two innovations tore down the traditionally dominant seams in the field of writing far more than the effect of the physical tools' miniaturisation or mobility. Additionally, it seems that mobility per se is of no great significance to writers. Neither the smartphone nor the tablet offers comfortable, realistic writing programs that reach beyond the writing of relatively short text messages. They are more suited to brief text, emoticons, and picture-based or postcard-like exchanges, but not for the production of significant voluminous text.

To understand seamless writing, changes have to be looked for in places other than the mobile attributes of the tools. Digital writing technologies and their integration into the writers' routines have evolved in several steps and successively replaced the older technologies of hand and machine writing, copying, the printing press and communication employing traditional postal services. New technologies have obscured the borders between writing, text design, communicating, storage, mailing, and publishing in order to arrive at solutions that make all of them manageable within a single system, the personal computer, laptop, or notebook. These innovations have happened successively since the 1980s, and each will be introduced step by step in the following sections.

2.1. Personal computers and word processors: The Big Bang of digital writing

The introduction of the personal computer and – connected to it – writing programs such as Corel's WordPerfect which was followed shortly after by Microsoft Word, were the first major step into the digital age of writing (see Mahlow & Dale, 2014, for a thorough account). The first digital typewriters can be ignored in this evolution as they were only a transitional technology with a limited range of digital features. These new writing programs from the early 1980s were commonly called word processors or text editors and offered writers something that was fundamentally new: the complete replaceability of any written word without need for erasers or mechanical replacement tools. Any word could be immediately, or at any time later, deleted and/or replaced by another. Letters, words and sentences could be removed in part or in whole from their original placement and shifted elsewhere in the text. Writers became able to work on any part of their paper and jump to any place within the text at will. The use of draft hardcopy versions became dispensable as text could be developed continuously. New opportunities to organise and structure text were provided by the outline function. Formerly complicated matters such as footnotes and registers could be created automatically. Grammar, syllable

division and spelling functions allowed for automated or semi-automated text correction without need to refer to a book on grammar or even a dictionary, both of which were soon integrated into these new writing systems.

This first step in the digitisation of writing was by far the greatest and most fundamental which laid the ground for everything that followed. Many seams were removed, which could be referred to as ‘media seams’ which formerly restricted the writer’s activity by the boundaries of symbol notation systems based on the physical painting or imprinting of letters onto the surface of paper (or any other non-interactive media). Removing these seams led to new ways of organising the writing process and new habits of connecting writing with thinking. The opportunity for a fluid arrangement of words on media led to a more elegant way of thinking by creating thoughts and evaluating their impact on the emerging text. Digital media freed the writing process from technical restrictions, connecting revision activities with rewriting the whole text and added new opportunities for idea generation, idea organisation and idea import from other sources. Sharples and Pemberton (1990, p. 2) labelled the new technological opportunities of digital writing as ‘externalizing cognition’ and explained this idea as, ‘In the place of a sheet of immovable text, the computer can provide a dynamic medium for exploring ideas and plans’. The now effortless changeability of the written word with the introduction of the word processor was the great technological breakthrough into digital writing. Technological changes that followed such as increased multimodality, the graphical designability of text, its exchangeability and reproducibility through web-based media, mobile telephony-related technology, new publishing opportunities, collaborative functions, and newly created automated feedback and intelligent tutoring systems built on this fundamental innovation.

2.2. Computer labs: New writing opportunities, yet an immobile technology

The expensive new computer technology entered education through the introduction of computer labs which, at the beginning, were the only access to computers most students had, even though families soon started to buy one of the new PCs and thereby children may have had limited computer access at home. For writing, it was essential that the computer labs were connected to printers, which at the beginning were even more expensive than the computers themselves. Computer labs, of course, produced new seams, restricting writing to a certain space and often also to a certain time. Switching between handwriting when taking notes in lectures or from books in libraries still was a common seam as was the restricted access to digital communication means.

All writings had to be printed out and carried to the readers or be transmitted by discs (sent by physical postal mail). In spite of these restrictions, computer labs were an important means to acquire digital literacy and to acquaint students with the basic MS-DOS commands of the dominant system software of the time.

2.3. Internet and e-mail: Removing the seam between writing and communication

Although developed separately, the Internet and email had similar effects on writing as both offered comfortable new ways of sharing texts with writers from anywhere around the world. The seam between writing and communication suddenly disappeared and sending a letter, now called email, was reduced to handling a fairly simple program and the pressing of a single button. One of the greatest seams of writing, and the exchange of texts, had been the postal system by which a paper had to be placed in an envelope and transported by mail carriers to another person or institution. Writing and communicating became manageable through a single system without writers and/or readers even having to leave their computer screen.

When the World Wide Web (www) was created, importing texts from sources or other writers became equally easy and the distribution of texts became independent of libraries, postal offices, and physical books. A simple 'www' address was adequate to access a particular text and then download it to an individual computer display screen. However, the reverse process of placing text onto one of the many websites (and thus making it visible to all) was not so easy. Uploading text onto the web, without knowledge of Hypertext Markup Language (HTML), required the invention of content management systems providing WYSIWYG ('what you see is what you get') editors to be used as easily as the word processor. The web reduced one of the greatest seams in writing, that between individually written text and published text. The web also provided the technological basis for the principle permeability of textual content between documents existing in different parts of the world on one of many servers connected through the Internet. Copy and paste became a common form of writing, even where it clashed with well-established rules of plagiarism and the ethics of writing. Search engines and online lexica such as Wikipedia provided easy access to all kinds of knowledge, and increasingly more knowledge became available in digital form. This revolution of knowledge distribution, again, reduced another seam, which traditionally separated the individual and the required knowledge which until then was in the form of physical books and papers, and knowledgeable groups of insiders.

New seams, however, emerged from the internal organisation of the web, making it difficult to assess the quality of the information provided and the intentions of the providers. While the boundaries excluding users from relevant knowledge were certainly reduced, new seams began to evolve between the various types of Internet content, thereby making it difficult to distinguish the quality of knowledge. Commercialised informational offerings and political propaganda were seemingly equal to trustworthy information. Learning to make the distinctions between different qualities became a new task for readers.

2.4. Learning platforms: Starting the age of virtual teaching and blended learning

The creation of local networks interconnecting individual PCs were soon surpassed by the internet offering a new powerful means for the organisation of learning processes and for communication within wider learning communities. The invention of learning platforms complemented the person-to-person meetings in teaching with virtual meeting places that allowed for the exchanging of texts within selected groups of students and their instructor(s). Communication and instruction regarding organisational issues could now be accomplished through the learning platform. Instead of depositing books and papers in the library, materials can now be scanned and provided electronically. The seam between the symbolic sphere of teaching (i.e. the texts, ideas and theories) on the one hand, and the physical sphere (i.e. the persons gathering in meetings) on the other was dissolving. Reading, talking, communicating and self-presentation became now part of one inclusive virtual environment. The age of virtual teaching and blended learning had begun. It also had established a completely new seam: that between the real and the virtual world.

2.5. Social media: Community building the digital way

The rise of social media and their new forms of social interaction, self-presentation, and digital interaction through such means as postings, likes, emoticons, texts and comments started its rise at educational institutions such as Facebook at Harvard University, but which soon expanded to become universally available. Given the popularity of social media among the younger generation, the question arose as to whether or not, and to what extent social media can be usefully applied to teaching and learning in schools (Richardson, 2010) and in higher education (Gülbahar et al., 2017). The accessibility of

social media through laptop computers and mobile telephony devices such as tablets and smartphones has ultimately made social media ubiquitously accessible. Social media, however, did not significantly promote the art of writing, but rather fosters the expressive opportunities of multimedia making it easier to communicate personal content.

2.6. Laptop, tablet, smartphone et al.: Learning becomes mobile

Mobile learning (Berge & Muilenburg, 2013) became one of the great trends of the 2000s, and inspired educational technology and pedagogy to reach beyond traditional classroom teaching and make learning universal, more communicative and able to bridge between formal and informal learning (Wong, 2015).

Connecting seamless learning with the transgression of contextual borders (or even the disappearance of contexts) and tying the nature of student learning to the availability of their own technological device(s) (through 1:1 availability), certainly pictures a kind of learning that moves well beyond the physical constraints of the classroom. Most writing, however, is undertaken outside of the classroom, as homework assignments from school, or as a seminar paper, essay or a thesis written as part of a university education. Mobility and 1:1 availability of mobile devices has not brought about much change for these writing practices. Students now write text on their laptop computers at home and carry them back and forth to school, much in a similar way to how they formerly carried their paper-based notebooks or, later, floppy disks. The main cognitive activities did not change because of the mobile devices but rather due to the new writing software and the exchanges through the Internet and email.

The optimism towards more ‘continuity of the learning experience across different scenarios or contexts’ as Chan et al. (2006, p. 6) expressed, may primarily apply to school teaching but it seems clear that it does not apply to university teaching which usually deals with more abstract matters to which the type of writing media is not of great relevance

2.7. Document sharing and collaborative writing: One text, many writers

New technologies massively impacted on the opportunities for collaborative and cooperative writing. Already, the invention of social media enhanced opportunities to cooperate on text production and share texts in a way that the paper age did not allow. There was, however, another invention that brought writers together in a new way to collaboratively write text. The invention of

document-sharing and (real-time) collaborative writing-tools such as Etherpad, Google Docs, Zoho Writer, and MixedInk brought about new potential for cooperation and distance writing that may have received less attention than other innovations but nonetheless, greatly impacted on writing. What had been a brazen limitation of writing – that only one person was able to write on a text at the same time – has fallen quietly behind with this new technology. Now, two persons or even larger groups can write the same text from many different locations and, additionally, collaborate through comments they may add or within chatrooms. The text, initially an individual product, which had become a social unit when placed on the Internet, now turned into a collective product. The disappearance of this seam enables collaborative text production without such traditional limitations as individual skills, ownership and responsibility. Collective text production merges the influence of several writers into one shared product. Even if the individual contributions to the text may be visible during the writing process (marked by different colours, for instance), the end product blurs all boundaries between the individual contributions.

2.8. Automated feedback, intelligent tutoring, and digital scaffolding: Reconnecting writing and instruction

New opportunities of cloud computing in connection with substantial pedagogical, linguistic and computer-linguistic research has led to a new generation of support measures providing writers with individualised instruction, guidance, and feedback (for an overview see Cotos, 2015; Allen et al., 2015). Many of these tools offer word processing for text production and connect it with additional instructive, evaluative and supportive measures. Here, the seams that traditionally separated writing from the teaching of writing are fading away. Writing to learn and learning to write merge indistinguishably: While students are writing on their assignments, they can draw upon a large variety of support functions, responsively providing them with the type of advice needed and offering the opportunity to learn something new about writing. Also, the seam traditionally found between writing media and learning media is disappearing. Traditionally, writers consulted books to learn how to write; for instance, a seminar paper or a thesis. Now, the writing tool itself contains the instruction from the books. The next section introduces one such tool, called Thesis Writer and demonstrates the kind of seamless writing it offers to its users.

3. THESIS WRITER: AN EXAMPLE OF A SEAMLESS WRITING ENVIRONMENT

Today, all of the aforementioned technologies are simultaneously in use. They depend upon each other and they support each other. Their complexity and pervasiveness in student learning is striking. Most learning is mediated by these technologies as today, almost no teaching is without an element of writing. However, the interrelation of new technologies with learning and their integration into teaching and working contexts is far from clear. Seamless writing as a concept may help track the impact of the new realities on student learning and the organisation of teaching. For an illustration this section briefly introduces the main functions of Thesis Writer (TW), and explain its pedagogical rationale. For a glimpse at TW beyond Figure 1, please open www.thesiswriter.eu. For a brief overview of TW, see Rapp, Kruse, Erlemann, and Ott (2015); and for an evaluation of TW, see Rapp and Kauf (2018).

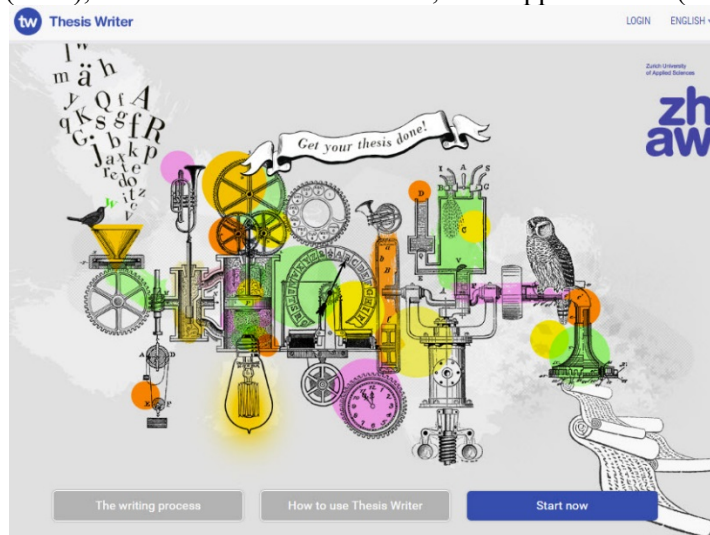


Figure 1: Start Page of Thesis Writer

TW is a new cloud-based bilingual (German, English) writing environment connecting writing with instruction on writing and research, collaboration, and supervision in a completely new way. To consider TW seamless is, of course, a keen attribute as reducing seams necessarily leads to new seams. It may be claimed, however, that traditional seams have been replaced in favour of newer seams which are more favourable to the organisation of thesis writing and the complex learning processes it entails.

The motivation behind the construction of TW was based on the observation that higher education students in Switzerland and Germany were

considerably underprepared for their first theses writing experiences at the Bachelor's and Master's degree level. After three years of study, students are generally tasked with writing an extended research-based paper for their Bachelor's graduation with very little experience, if any, in academic writing or research writing. The situation for Master's students is somewhat less dramatic with most having already written a thesis for their Bachelor's degree, yet they may face harsher standards of scientific scrutiny or scholarly precision in the evaluation of their writings. For university instructors, thesis supervision is a highly time-consuming and hence costly activity (if performed well) and forces them to repeat similar instructions to their students many times over. From an institutional standpoint, the management of thesis supervision for large numbers of students (e.g., up to 800 students a year in the authors' department alone) demands considerable manpower capacity (for a discussion of TW's contribution to scaling learning, see Rapp & Kruse, 2016). TW intends to support all three interested stakeholders – students, instructors/supervisors, and institutional management – and aims to help interconnect their activities better.

The construction principles of TW rest on two main ideas: A process-based approach helping writers to organise the writing process, and a rhetorical or genre-based approach, helping students master the structural and linguistic aspects of their text. TW not only organises the writing process, but also helps understand and master the intertwined research process that usually forms part of the dissertation project. For institutional users, TW provides a customized, institutional page which offers the ability to add local instructions or standards on thesis writing and provides a communication channel for institutional users. TW contains some 100 short tutorials about writing and research, linked to different places of the platform and phases of the writing process in order to make them available whenever needed.

Thesis writing: The whole process

Thesis Writer is a learning platform that assists you in writing your thesis. Use our online editor and the structured templates to create your text. Study the tutorials prepared for every step instructing you how to proceed with your project. The writing process is partitioned in four sections. See below what each one is about.

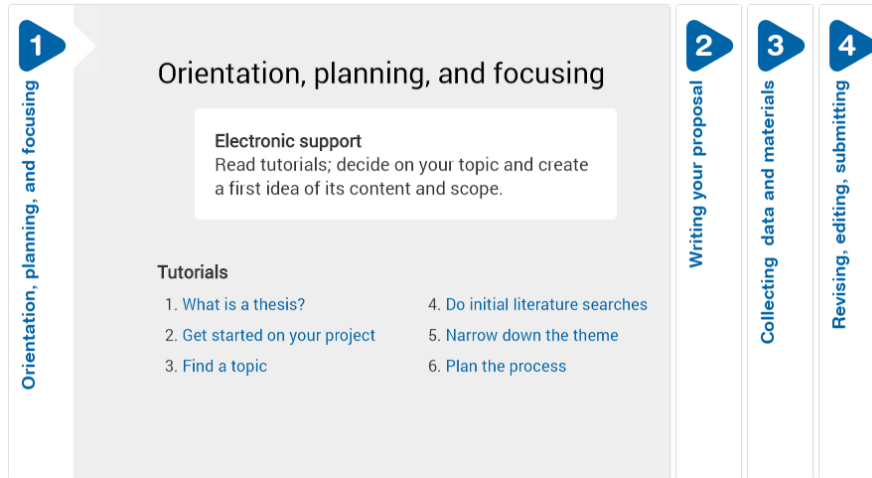


Figure 2: Process approach of writing used in Thesis Writer (“road map”)

The workflow in thesis writing is guided by a road map (see Figure 2) which separates the writing process into four separate stages. The first two stages deal with the preparation and planning of the thesis, whilst the third and fourth stages address data collection and composing/revising of the text. Each stage has a text editor with a number of support functions made available. When one stage is completed, the tool will transfer the text to the next logical stage where it may be connected with different instructions and different help functions.

The rhetorical stage is guided by an extended version of the IMRD (introduction, method, results, discussion) scheme which is referred to as the ‘research cycle’ (topic, research question, state of the art, knowledge gap, relevance of research, method, results, interpretation, conclusions; Kruse, 2016) as depicted in Figure 3. This scheme is used to help students understand the main steps in planning and reporting research. They are invited to organise their own ideas and working results along the lines of this standard structure and are supported by several tools in order to understand the meaning of each section. This structural support is complemented by rhetorical advice showing writers which options they have, for instance, to formulate a research question or indicate a research gap. In the second step of the working process, writers receive support through in-built help functions to organise the research

material they have gathered and to structure a report about their project in several steps of revision activities.



Figure 3: The Research Cycle, rhetorical structure used in Thesis Writer

Additional support tools (see Figure 4) for mastering the writing/research process are: (1) examples for each section of the proposal, (2) a phrase book (tied to each section of the proposal), and (3) a search tool for real-time queries from a large corpus of research papers. When writing their proposals, students can find these functions for each section of the research cycle and then select a number of typical phrases; for instance, how research communities would usually address a research question or indicate the meaning of their research.

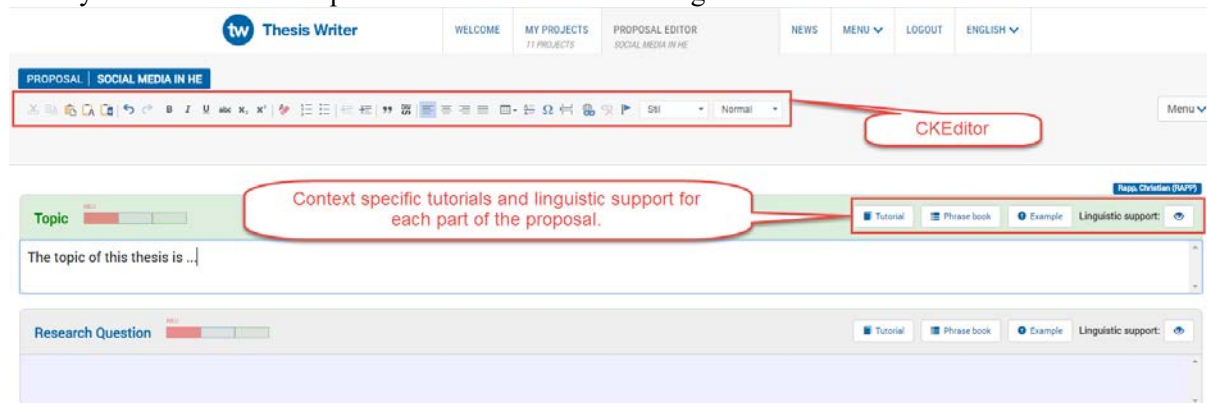


Figure 4: Support tools provided in Thesis Writer

Based on this short description of TW, it can be inferred which kinds of seams the learning environment removes or changes. TW demonstrates the

high integrative capacity which the platform has for connecting writing, learning, research activities, and the organisation of teaching. Some of the seams encountered clearly relate to those that Wong and Looi (2011) systematised in their review, even though it appears that seams have to be determined for each single task and learning context.

Not all of the 10 MSL dimensions described by Wong and Looi (2011) are relevant to writing. As described above, in writing seams such as restrictions in learning across time or location (dimension 3 and dimension 4) had already been superseded with the invention of paper, the pen, and the printing press. TW does however strengthen the ubiquitous access to learning resources (dimension 5), as compared to the conventional way of thesis writing. A learning environment like Thesis Writer changes the availability of learning opportunities and the access to learning resources. When considering changes in the relation of formal to informal learning (dimension 1) and of personal to social learning (dimension 2), it could be noted that a tool like TW considerably changes the personal meaning of writing and adds new opportunities for connecting writing with communication and virtual cooperation. In contrast, Wong and Looi's (2011) reference to the availability of multiple devices (dimension 7) is of only minor relevance in understanding the impact of TW on writing, as TW primarily depends on comfortable ways of text input by users of a computer or laptop rather than on the mobile quality of the devices. Nonetheless, TW is independent of both platform and device and is sufficiently responsive to allow for smartphone use. TW definitely changes the opportunity of 'seamless switching between multiple learning tasks' as proposed by Wong and Looi (2011, p. 20) (dimension 8) by connecting such tasks as orientation, planning, writing, feedback, and communication with others. TW breaks down the workflow of thesis writing to elements that had previously been carried out at separate places and reconnects them within the platform. In addition, TW leads to certain changes in the students' ability to synthesise knowledge (dimension 9), which is always a primary aim of academic writing. When students start working with TW, they should already understand the principles of knowledge construction and synthesis. TW then helps them to deepen their understanding of the basic elements of academic genres and offers new access to the constructing and synthesising of knowledge. Considering the 'multiple pedagogical or learning-activity models' (dimension 10) it is noteworthy to consider that thesis writing leads to new models of the writing/learning process, but that it unifies thesis writing rather than splitting it up into separate activity models.

The main seams identified (instead of seams they could also be referred to as problems, limitations, or obstacles for learning) can be summarising as four main dimensions:

1. *Seam between writing and learning*: Learning to write and writing to learn are usually two different and differently taught aspects of writing. However, in TW, both are integral elements of the learning platform so that writers get help whenever they need it and do not lose time searching for solutions to their learning needs. The platform is arranged in a way that new help functions can be added when deemed necessary.
2. *Seam between writing and research*: In thesis writing, at least some research activities are inevitably involved and the seam between writing and research separates into two distinct patterns of activity, with each consisting of different timing, management activities and thinking skills. While in writing, students have to sit, read and create text, in research they have to carry out activities such as searching for literature, conducting interviews, collecting data, looking through archives, or interpreting historical documents. Although this seam between these two kinds of activity will never disappear, it is proposed that TW better connects both activities and dissolves frictions in students' activity patterns.
3. *Seam between writing and communication*: Traditionally, writing isolates writers from each other and separates situations where writing takes place from those where communication happens. TW offers users the opportunity to communicate whilst writing, for instance, by inviting other students or their supervisor to access and review a section of their developing thesis in order to receive immediate feedback and discuss the text. Additionally, collaborative writing can be done in TW without exchanging text through emails or learning platforms. All partners can write within the same document and propose changes or post comments.
4. *Seams between actors or stakeholders involved in thesis writing (students, supervisors, and institutional administrators)*: The actions of these three stakeholders become integrated better than before. The tool provides a meeting place for all stakeholders and arranges their actions in a meaningful way.

4. CONCLUSION

Seamless learning is an approach aimed at conceptualising learning spaces with respect to their integration and contextual adaptation. The pedagogically sound use of digital technologies in education is able to bridge seams and offer new foci in respect to organising teaching and learning processes. Seamless writing contributes to this field by studying the uses of writing technologies within the workflow of individual learning and as a part of the management

of student writing/learning within educational institutions. However, in comparison to the existing conceptualisations of seamless learning, different seams now come into focus and different ways of seamlessness may therefore need to be studied. It is anticipated that such research would not only help to refine the concept, but also increase its breadth.

In the past, two major issues and their consequence have been studied in the context of seamless learning: mobile learning, and the ubiquity of learning given the widespread and affordable availability of the respective technologies. Both, it can be said, have significantly changed the situation of learners and of learning itself. However, when considering the technological development in the field of writing, it has to be noted that digital writing technology has considerably moved the field towards ubiquity in learning and learning anywhere already a long time ago. Reading and writing could be practiced wherever there was paper available, or a book, and adequate light from which to see. We suggest to de-emphasise the importance of the mobile and ubiquitous dimension in the seamless learning concept in exchange for a more cognitive and communicative view. A learning platform like TW organizes student thinking anew and provides new ways of gaining orientation in this difficult task. It will be necessary to study the user patterns more closely and understand better how students gain from using TW and its various support functions.

Thesis Writer – does it produce new seams? Of course, as any cloud-based tool only works when there is an accessible internet connection. Seamless learning may be a desirable goal for learning but similar to other value-based aims (please think of justice, health, or critical thinking), is also a fiction that never can be fully reached. Cloud-dependent tools like TW divide the world in places where internet is available from those where it is not. Working on a train might prove difficult when the train company does not provide Internet access. New seams were also produced between writing and other support programs like literature management systems, Excel spreadsheets, and graphics programs which, at the moment, cannot be integrated into TW due to current technical limitations. Of course, this may change in the future, but should these seams be removed, in its place may be a seam that opens between different groups of students: Users who are not skilled in using technology or find TW too complex will become separated from those that can readily use the new tool. In this case, technology itself becomes a seam separating students from their learning opportunities. For this seam, there is no conclusive answer; not as yet.

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