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On-site learning

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Introduction

This chapter discusses landscape construction teaching methods that focus on learning through on-site learning activities. These student assignments use built landscape works as the source of enquiry and learning.

The current generation of students has grown up with an almost endless availability of digital information. In an ever more complex world taking students out of the classroom away from their desktops and laptops and into the field has become more important than ever. Educators therefore need to develop new teaching methods that engage students in the learning process, increases their attention and motivation, and promote active listening, refection, problem solving and creative thinking.

Built landscape is a dynamic system influenced by factors such as material selection, weathering, use and abuse, succession and maintenance. In order to understand this complexity, construction teaching in the classroom needs to be accompanied by on-site learning activities and assignments that link theory with practice by engaging the students in active learning.

Case studies of courses at the Technische Universität Berlin (TU Berlin) and Harvard Graduate School of Design (Harvard GSD) will illustrate the significance of integrated field learning activities. Both schools use the site as an essential source of knowledge in their methods of teaching and combine classroom teaching with a broad range of on-site learning activities.

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> *'Not having heard something is not as good as having heard it; having heard it is not as good as having seen it; having seen it is not as good as knowing it; knowing it is not as good as putting it into practice.'* Xunzi [Teachings of the Ru] (Trans. J. Knoblock. 1988: Book 8, Chapter 11, p. 81)

A research project at the TU Berlin entitled '*Landscape architecture and the time factor: Construction research on the contextual change of built landscape elements and the development of optimisation strategies'* is currently developing a low-threshold and non-destructive cyclic monitoring method for identifying frequently occurring points of weakness and patterns of change to built landscapes works through field research. The method being developed allows practitioners to monitor the development of built works after completion and provide clients with recommendations for optimisation. This cyclic monitoring method enables 'Lifelong Learning' from built works throughout ones academic and professional career. The research project is running hand in hand with teaching, allowing for continuous curriculum improvement and for students to focus on the core themes of the investigation through seminars, workshops and thesis topics. The initial findings highlight frequently occurring points of weakness in landscape detail design caused by **contextual factors**, **component quality** and **operating conditions** throughout the project cycle (Fig. 1).

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Category	Cause criteria
Context	**Site and contextual factors** Change/decay due to degree of exposure, aspect, access and circulation etc.
Component Quality	**Design and detailing factors** Change/decay due to due to quality of design, detailing and durability features
	Material specific factors Change/decay due to material suitability and/or quality.
	Implementation factors / workmanship Change/decay due to quality of implementation, workmanship (conformance with construction standards and guidelines)
Operating conditions	**Environmental processes / weathering** Change/decay due to environmental processes
	User actions / usage Change/decay due to intensity of use and/or misuse (physical stress caused by humans, animals, plants, vehicles etc.)
	Maintenance and repair Quality and frequency of maintenance and repair
	Force majeure Level of impact of incidents such as flooding, fire, riots etc.

Figure 1: Identifying the causes of change to built landscapes over time. (based on Kirkwood. 1999: pp 166-177 & Colwill 2016: p 398)

The repetitive nature of these weaknesses underlines a distinct lack of knowledge within the profession of the processes influencing change through time. These results point towards education as one of the key priorities for improving the understanding of weathering, temporality, durability and time based change within the profession, and therefore, for optimising the durability and sustainability of contemporary landscape architecture projects (Colwill, 2016, pp 399-400).

On-site assignments that engage students in analysing the built environment and critically reflecting on what they are experiencing significantly enhance construction teaching methods. This provides the students with multifaceted information that is often difficult to convey in the classroom. They combine otherwise separately taught course content such as planning, design, context, scale, proportion, material characteristics, haptic and optical qualities, together with the influences of weathering, use, maintenance and durability over time. This enables integrative learning in all fields of landscape architecture, urbanism, sociology of space, climatology, construction, maintenance and management.

These field activities are vastly enriched when accompanied by the project designer, construction or maintenance firm and/or client together with the design and construction drawings. The first hand experiences of project stakeholders enable for example discussion on contradictions between design intention and construction, key problems and solutions during the planning and construction phase together with issues of performance over time. Guest lecturers from designers and industry experts bring professional practices and new perspectives from the 'real world' into the classroom. The key aim hereby is to establish a dialogue between academics and practitioners, linking theory to practice, taking students to the field and bringing professionals to the classroom for mutual benefit.

The site itself is an invaluable source of knowledge at each stage of project development:-
Prior to construction the existing topographic features of the site can be investigated, critical issues such as existing structures and vegetation evaluated, the character and genius loci (the distinctive atmosphere) of the site experienced, and the impact of development deliberated.

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During the **construction phase** students learn from the scale and complexity of the construction site and gain a feel for craftsmanship, construction techniques, foundations, detail design and materials, much of which are no longer visible after completion.
In the **post completion phase** students experience built landscape as a dynamic evolving system interacting with the natural environment and patterns of use. This also allows reflections on the design, the vocabulary of landscape detail, the durability of materials, and the processes of change through time. '*Reflection is an important human activity in which people recapture their experience, think about it, mull over & evaluate it. It is this working with experience that is important in learning*' (Boud & Keogh & Walker. 1985 p 43)

There are, however, two major hurdles regarding landscape technology field trips. Firstly, learning in one context, does not easily transfer to another; therefore it is essential that students experience a broad range of projects and detailed design approaches. Secondly, taking students out of the classroom is becoming increasingly difficult within academic institutions especially with regard to building sites due to increasing amounts of safety management issues and the administration necessary.

Methods

The teaching methods developing from this research aim to improve learning by involving students in onsite surveys, analysis and evaluations of 'real' projects and construction details after completion. This enables students to experience built landscape as a dynamic evolving system interacting with the natural environment, patterns of use and maintenance regimes within an academic context. These teaching methods follow the '*Experiential Learning Cycle'* model of learning through experience and discovery developed by the educational theorist David A. Kolb (1984). The model employs a learning cycle that generally begins with **Concrete Experience** (doing, having a specific experience e.g. on field trips or on-site assignments) moving to **Reflective Observation** (review, reflect and discuss the information gathered from different perspectives before making a judgement) then to **Abstract Conceptualisation** (draw conclusions, learn and develop a clear understanding of the theory) and finally to **Active Experimentation** (applying what you have learned to new situations) (Fig. 2).

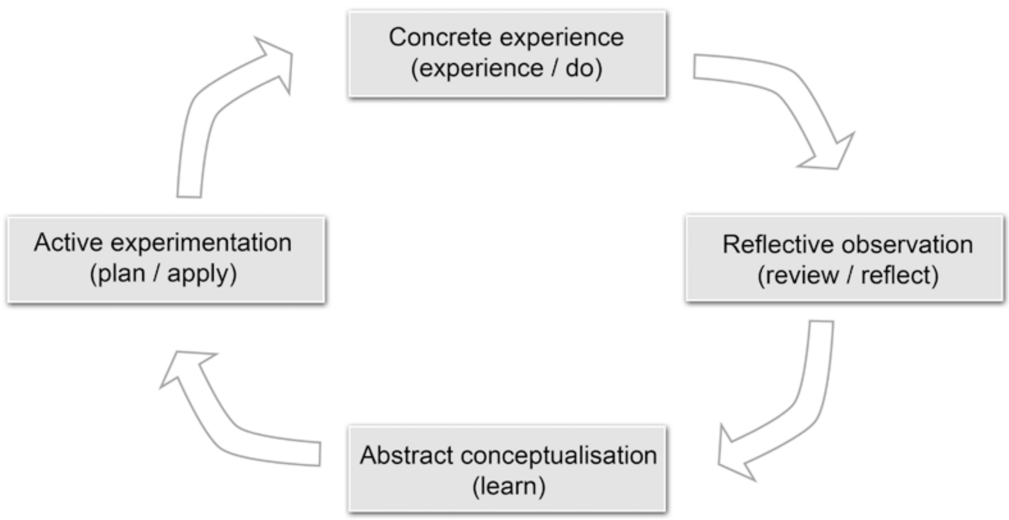

Figure 2: The Experiential Learning Cycle. (based on Kolb. 1984)

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The most effective learning takes place when learning involves all four stages of the cycle. Kolb describes experiential learning as '*the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience'* (1984: p 41).

It is generally accepted that people learn in different ways, whereas some students achieve through classroom activities others can grasp complex theory and concepts through interaction with real life situations. There are many models and theories on learning preferences; the VARK model developed by the educational developer Neil Fleming presents four different learning strengths and preferences (Fleming. 2012: p 1).

> **Visual learners** learn from what they observe. They prefer learning from images, drawings, diagrams, charts, graphs, mind maps etc.
> **Aural learners** (or auditory learners) learn from what they hear. They prefer learning through lectures, discussions, podcasts, oral presentations etc.
> **Read/write learners** learn from read or written words and by taking notes. They prefer learning through books, texts, essays etc.
> **Kinesthetic learners** learn from what they touch, feel and do. They prefer learning through multi-sensory experiences such as field trips, real-life examples, hands-on projects etc.
> (based on Fleming. 2012: p 1)

Many learners show a strong preference for one of these learning styles, while others are multimodal and have any combination of two, three, or four preferences. Multimodal learners are flexible about how they learn, however, to improve learning various modes of learning are often necessary (Fleming, 2012). Research from J. Sarabdeen (2013, p. 1) states that for multimodal learners '*The practical implication is that the trainers should adopt various learning strategies to achieve the learning objective*'.

> '*Teaching often reflects the teacher´s preferred teaching style rather than students´ preferred learning styles.*' (Fleming & Baume. 2006: p 5)

The results of a learning preference survey at California Polytechnic State University from 2010 – 2012 showed that the highest preference amongst 85 architectural students is Visual (48%) followed by Kinesthetic (26%), Aural (14%) and then Read/Write (12%). Furthermore, roughly 40% of all students '*would be defined as having multiple preferences that include both Kinesthetic and Visual'* (Nelson, 2013). These results enable educators to use teaching methods that reflect the learning strengths and preferences of specific groups of learners in a course in order to increase learning outcomes. Integrated field learning assignments are mainly kinesthetic and visual learning activities, and thus address a large proportion of architectural student's preferential learning styles.

Case Studies

The following case studies from Harvard University and TU Berlin aim to show how diverse teaching methods involving site interactions ensure a thorough understanding of construction technologies and techniques. Both of these schools use the site as a source of knowledge through field trips and field research assignments.

Case Study 1 - Harvard Graduate School of Design

Course title: '*Landscape Technology as Design: Material, Tectonics and Time*'
Program: Master of Landscape Architecture

The course is supervised by Professor Niall Kirkwood, a Professor of Landscape Architecture and Technology at Harvard Graduate School of Design (Harvard GSD) since 1992, and Alistair McIntosh, a lecturer with over 35 years of landscape practice and teaching experience.

Before teaching at Harvard GSD Niall Kirkwood worked in landscape architecture and architecture private design practices in the United Kingdom and the United States for 18 years and gained hands-on practical experience through supervising the field construction of built landscapes, infrastructures and buildings in Ayrshire Scotland, London, Barcelona, Columbus Ohio and New York. One of his many fields of research is landscape detail design, traditional and emerging construction technologies, and the on-going durability of built landscapes. His books entitled 'The Art of Landscape Detail: Fundamentals, Practices and Case Studies' (1999) and 'Weathering and Durability in Landscape Architecture: Fundamentals, Practices, and Case Studies' (2004) provide pioneering information on the theories, approaches, and practices of landscape detail together with the weathering, durability, and physical changes in the designed landscape over time. His teaching methods reflect this research by employing a diverse variety of methods and techniques in order to address the complexity of landscape detail design.

The objective of the course is to develop '*a critical understanding of both tested and emerging practices of detail design and construction in landscape architecture, address the interdependence between site, design, technology, tradition and innovation in the making of landscape architecture and how this can inform function and expression in landscape design work at a range of project scales*' (Kirkwood, McIntosh. 2017). The course is split into two main components, 'The Indoor Classroom' involving a series of lectures and workshops, followed in the second half of the semester by the 'The Outdoor Classroom' with field trips to a wide range of historic and contemporary built landscapes. The individual course assignment runs parallel to the classes throughout the semester.

Figure 3: The outdoor classroom. Active discussion of detail design and construction issues. Harvard GSD (Photo: N. Kirkwood. 2016)

The Indoor Classroom - *A series of lectures, discussions and interactive workshops*
The lectures focus on issues of landscape technology, materials and construction, detail vocabularies and tectonic syntax, weathering and durability, structural principles and soft engineering. Accompanying workshops aim to demonstrate how the above concepts are integrated into practices of design development. Class participants engage in an interactive analysis of case studies through the use of the diagnostic section. The concepts and methods introduced in the Indoor Classroom form the basis for students to analyse and comprehend what they physically experience during the field trips.

The Outdoor Classroom - *A series of field trips*
The field trips or 'Outdoor Classrooms' address a wide range of approaches to landscape design and construction. The sites are selected to allow students the opportunity to observe and engage in a wide range of landscape programs, detail languages, material applications, design form and expressions, from varied landscape architecture offices.

The course assignment consists of three main parts:
Part 1. A technological critique of a landscape architecture project from the last twenty-five years is carried out. Particular focus is placed on the application of detail design at a range of scales and tectonic applications.
Part 2. This involves the research, design and Reverse Engineering (derivation of detailed information on design, construction and operation from an existing object) of a detail design landscape prototype that must be described in a material and tectonic manner over time.
The **detail design prototype** is of a complex nature consisting of a variety of interrelated natural and constructed boundaries, transitions, surfaces and objects derived from a Diagnostic Section. The **diagnostic section** is a **research and development** tool involving both technical design analysis and the development of optimisations. Built elements are broken down through **reverse engineering** into their constituent parts in order to comprehend how they were constructed. Diagnostic evidence is also added to assess the

current condition. This enables students to critically analyse built landscape works, derive constructional features and evaluate performance through time. The facts established in the same diagnostic section can then be used to inform the speculative development of new built works.

Part 3. The **detail design prototype** is now applied to a new geographic location taking into account the specific site topography, micro-climate, soils, groundwater, availability of materials, labour and cultural context. The prototype needs to be modified to ensure the necessary performance over dedicated periods of time. Throughout the workshop and field exercise the '*Students learn and apply methods of observation that enable a critical understanding of existing built works and apply those insights to the productive development of their own landscape proposals from the conceptual to the detail scales*'. (Kirkwood, McIntosh. 2017)

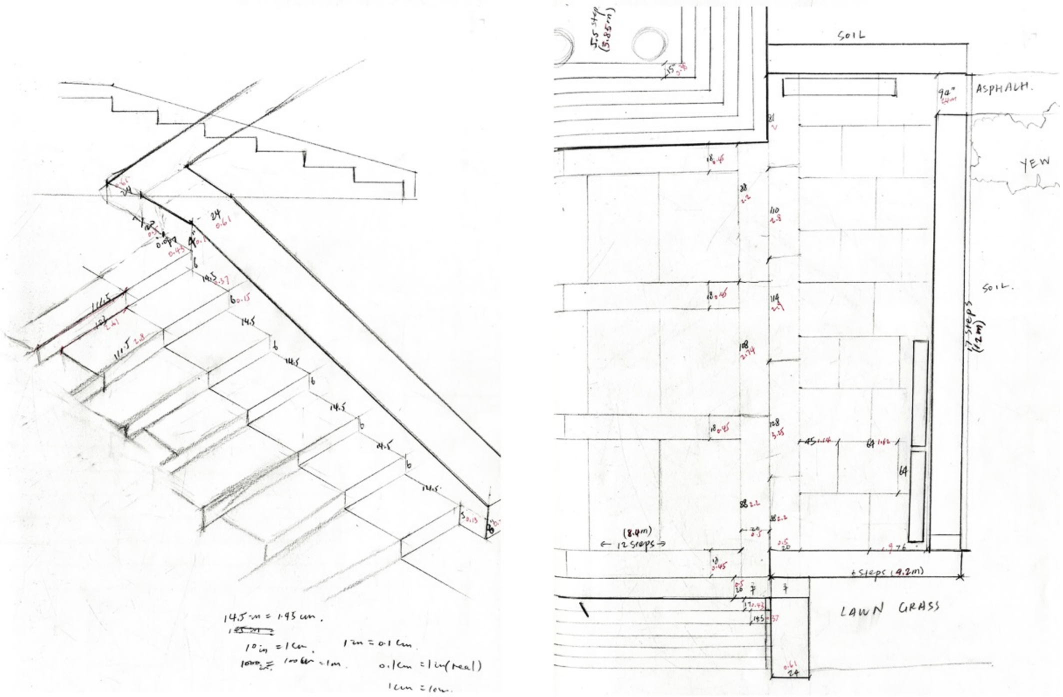

Figure 4: Initial site investigation sketches from Part 1 as a basis for the diagnostic section. X. Yuan. Harvard GSD (2016)

Case Study 2 - Technische Universität Berlin
Course title: 'Landscape C*onstruction and Materials*'
Program: Master in Landscape Architecture

The course aims to develop understanding of how initial conceptual ideas are transformed through design development processes into concrete landscape proposals whilst addressing the implications of the specific site, function, design, construction, materials and the dynamic nature of physical change over time. This involves the creative transformation of physical materials through techniques of landscape construction into a vocabulary of built landscape form. Students need to develop a critical understanding of current, new and emerging methods of detail design and construction, a thorough knowledge of the qualities and properties of materials, together with a clear understanding of the factors influencing patination and deterioration. The course is split into a series of classroom based learning activities involving lectures and seminars supported by on-site learning activities focussing on the detailed analysis of built landscapes.

Figure 5: Field trip to a concrete plant enabling in-depth learning of production techniques. TU Berlin (Photo: C. Schellhorn. 2015)

Classroom learning - *A series of lectures, seminars, discussions and workshops*
The classroom learning activities involve a series of lectures and seminars, held by university staff and visiting experts, focusing on developing knowledge on the interrelations between site design, detail design, building materials, construction detailing, structural engineering, maintenance and the processes of time-bound contextual change. These take place parallel to the progress of the field based exercises. Guest lecturers are invited to present specific project case studies that further illustrate course content.

On-Site Learning - *Landscape Forensics*
Assignments within our construction seminar for masters students involves students in small groups going to 'real' landscape projects and analysing situations in detail before formulating a tailored response. This is set as a research question, the object of research being 'real' landscape projects. Students examine the current condition in relation to the surrounding context and reflect on interrelations between site design, detail design, building materials, technical implementation, maintenance and performance issues. Comparisons with images in publications at the time of completion, together with project descriptions or reviews enable the students to identify time bound changes to the built landscape, as well as discrepancies between design intentions and the built reality. Teacher support enables the students to 'read' and interpret the traces of wear and tear, weathering, maintenance and succession in order to determine, for example, patterns of use, misuse, maintenance and/or points of weakness. The factors influencing change through time are introduced in a classroom learning context prior to the on-site interactions serving as a basis for 'reading' and interpreting the condition (from patination to deterioration) of the projects and detail elements under examination. An on-site lecture from a practitioner is also organised to a current construction site or recently completed landscape architecture project.
This on-Site Learning based on what we call '**Landscape Forensics**' which is a form of learning by examining the problems and failures arising on built landscape works through time. Furthermore, the location, spread and intensity of patination and decay allows specific vulnerabilities and weaknesses to be identified. Through analysing the **root causes of failures** methods for deterring future failure and enhancing durability can be derived. The method reflects on the entire design, construction and post completion phases of the project together with the current state of maintenance. The cause criteria listed in Fig. 1 form the basis for this analysis.

The course assignment consists of four parts:
Part 1. The students perform an on-site examination and critical analysis of a built landscape architecture project completed in the previous 20 years.
Part 2. This involves the technological critique of a landscape detail within the selected site through **reverse engineering** and interpretation. The built element including the surrounding context is analysed with regard to the appropriateness of the design, construction and materiality together with the implications of functionality, location, weathering and durability. Points of weakness are identified that due to their exposed position (corners, edges etc.) or particularly high demands (intensively used surfaces, surfaces with ground contact etc.) are exposed to greater levels of stress than other areas of the same element. The root causes of time bound change are assessed according to the factors listed in Fig. 1. In-use **condition assessment** takes place by analysing the differences between the current and original condition. This evaluation method is being further developed in the before mentioned research project. Change can be classified into those which are purely cosmetic and those that lead to a reduction in aesthetics, functionality, stability, and/or durability. Therefore a qualitative assessment of the following factors is carried out:

> **Aesthetic condition**
> From the initial process of cosmetic patination to the latter phase of visual degradation
> **Functionality**
> Usability, function, process-related serviceability and safety
> **Stability**
> The carrying capacity of the structure at the time of the survey
> **Durability**
> Ability of structure to withstand damaging impacts through expected service life, during scheduled use and maintenance

The students produce a variety of texts, photo documentations, diagrams, sketches and detail drawings to present their results; an example is shown in Fig. 6.

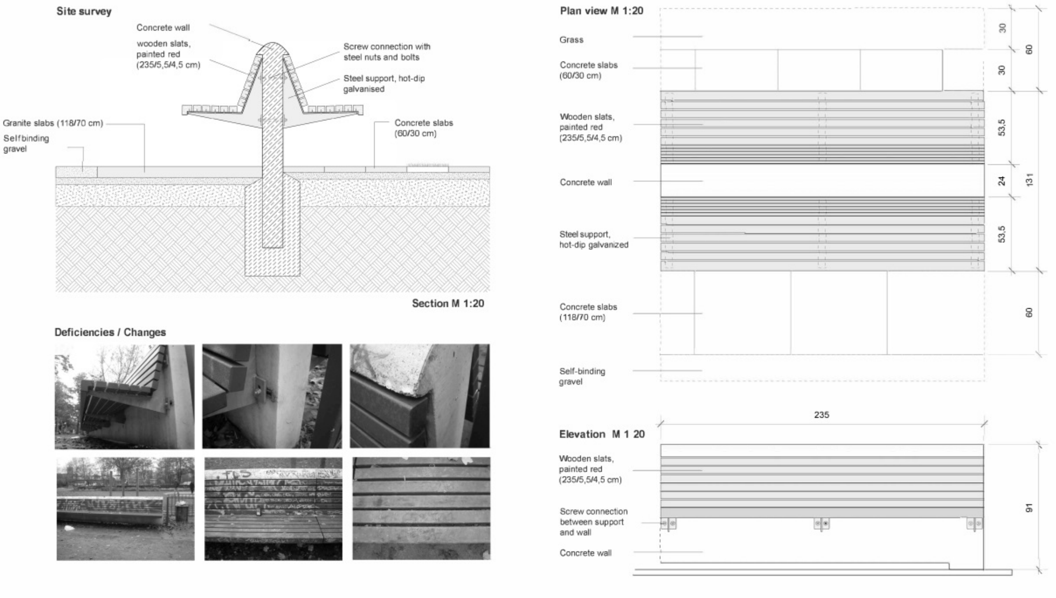

Figure 6: Excerpt from a submission for Part 2 –Landscape detail critique and reverse engineering drawings. F. Karle. TU Berlin (2012)

Part 3. An optimisation strategy is then developed within a classroom learning context for the selected landscape detail with regard to the specific requirements of location (weathering, use intensity, level of maintenance etc.), use (form, material etc.) and for deterring constructional and material vulnerability.

Part 4. The landscape detail is redesigned for a specific location using the knowledge acquired from the analysis in part 1 and 2 together with the optimisation strategy from part 3. A complete set of design and construction drawings and a scale model are then produced for the optimised landscape detail following standards for architectural construction and working drawings as shown in Fig. 7.

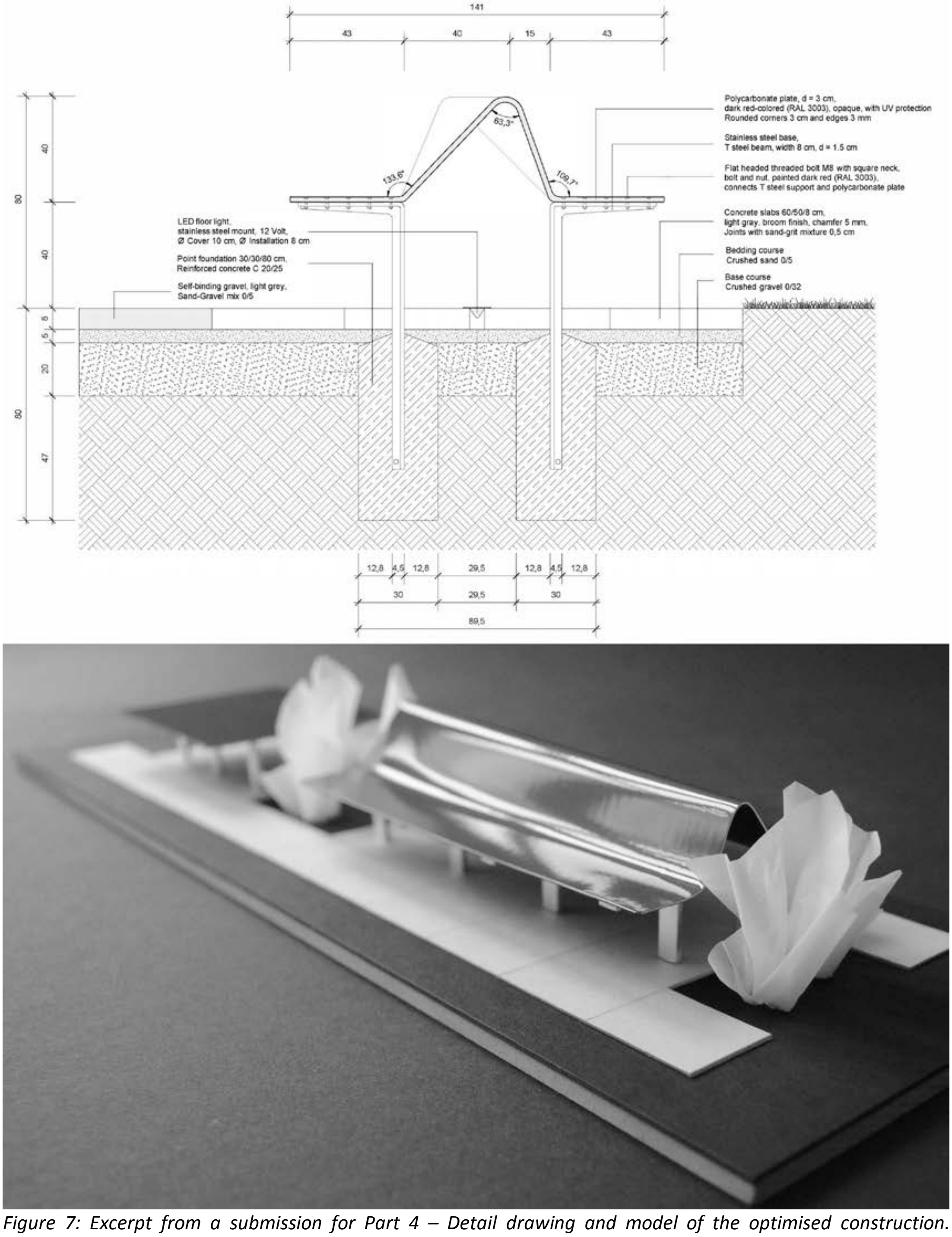

Figure 7: Excerpt from a submission for Part 4 – Detail drawing and model of the optimised construction. F. Karle. TU Berlin (2012)

Discussion

The learning approaches presented here enable an integrative approach to teaching landscape construction by treating built landscape projects as research objects and engaging students in on-site research activities. Both courses use the site as an essential source of knowledge, a learning instrument informing the students on real life situations in the dynamic realm of time and change. The learning objectives are to provide students with techniques for design exploration through critical observation, technical thinking, and for monitoring the performance of built landscapes through time.

Reverse engineering is a key teaching method of both courses and is based on a process of enquiry through observation and research. On-site observations of the current condition lead to the students posing questions regarding the design, construction, materials and the mechanisms of change. Individual research is then necessary to develop their knowledge, in order to analyse the site and its component parts in detail. The aim is to develop methods to critically analyse built landscape works, deduce the root cause of problems, evaluate performance through time, and develop optimisation strategies and solutions. This process is assisted by teachers who guide the students through the deductive process.

The course assignments not only aim to exercise and develop the tools, techniques and technologies of detail design practice in landscape architecture but also to predict and adjust to factors that affect the durability of landscape architecture projects over time. During these on-site assignments, students confront all facets of a project simultaneously, they need to think, discuss and analyse built landscape before formulating a judgement and an optimal response. The processes of observation, **technical thinking**, reflection and causal research enable a more founded development of innovative solutions. The role of the teacher in this process is as an educational coach, guide, and mentor who, if necessary, recommends alternatives for ineffective practices and/or teaches possible alternatives. These teaching methods complement the more traditional techniques in lecture halls and seminar rooms.

These teaching methods attempt to equip students with the tools necessary for **lifelong learning** from monitoring the development of both their own built landscape architecture works and the works of others. The assignments demonstrate to students how knowledge from built landscapes can be extracted and interpreted to inform future projects. The case studies follow Kolb´s (1984) cyclical model of ‘experiential learning’, from the on-site data collection (experience/do) to the analysis (review/discuss), the formulation of optimisation measures (learn) and the development of an optimised solution (plan/apply) (Fig. 2). Through repetition of this research cycle, a spiral process of continual learning and optimisation (Fig. 8) can be achieved. This process of **Research and Development** is similar to the monitoring methods currently being developed by the author within the previously mentioned research project.

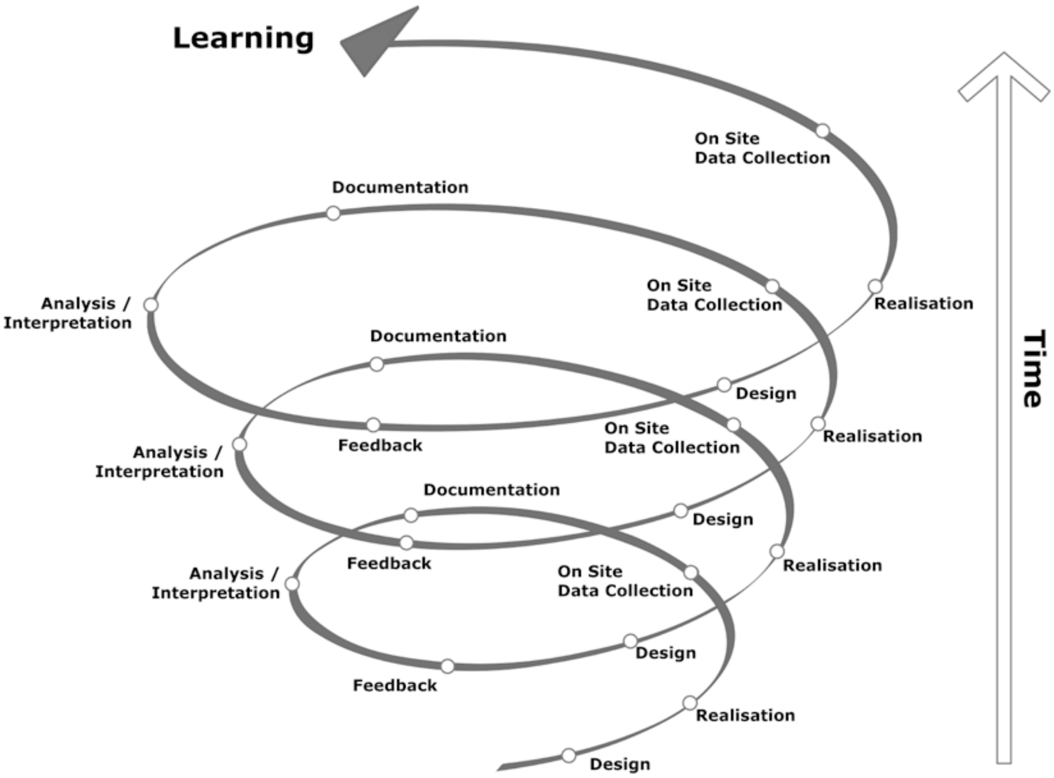

Figure 8: The spiral process of continual learning and optimisation

The diversity of teaching methods also allow the courses to follow Neil Flemings VARK model of learning, optimising learning outcomes through addressing the preferences of a wide range of learning types, which in turn, often leads to increased group motivation.

One of the bonus effects of these teaching activities is the passive learning that occurs. Observations of scale, form, materials and their surfaces, use, abuse, maintenance, and climatic interactions with the site allow ‘real world’ insights into landscape architecture projects within an academic framework. The problem solving ‘reverse’ assignments involving active learning and participation also enhance the learning experience by proving an activity in which the students can learn from each other. Boud, a professor of adult education, describes this ‘peer learning’ as the ‘sharing of knowledge, ideas and experience between the participants.’ (2001: p. 3). The participants work collaboratively, give and receive feedback, and develop a wide range of skills. This engagement is reflected in the quality and diversity of the coursework.

Conclusion

The teaching and learning methods discussed in this chapter demonstrate a shift of emphasis in the pedagogical framework of teaching landscape technology towards landscape performance, change, temporality and monitoring. Field-based learning assignments form an essential component in understanding theses complex relationships. The intensive on-site learning assignments involve observation, inquiry, and critical reflection on what they are investigating which triggers deeper, active learning. Hickcox (2002) explains that field experiences are student-centred learning activities, enabling the application of ideas and concepts taught in a traditional classroom context to a specific environment that stimulates critical thinking and analysis. They provide students with the opportunity to contextualise their classroom learning in the 'real world' of the built environment, therefore linking theory and practice. Both case studies presented here aim to improve teaching practices, enhance student learning, increase student engagement, and better prepare students for the complex requirements of the profession. The teaching methods focus on the relationship between site, design, landscape technology, and the dynamic forces of weathering and usage over time. The depth and complexity of the student results demonstrate a multifaceted technological understanding of landscape architectural detail design.

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