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HYBRID ACTION-ORIENTED LEARNING AND TEACHING: A TRANSFORMATIVE APPROACH TO VOCATIONAL EDUCATION

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Abstract

In the domain of vocational education, experiential learning constitutes a pivotal component of instructional design, encompassing the execution of experiments and the engagement with (model) systems. These practices are embedded within the didactic concept of action orientation, a mandatory component in Germany's curricular standards. The implementation of learning and teaching activities as hybrid teaching thus presents challenges for teachers, since on the one hand hybrid teaching is required by both learners and companies, and on the other hand the action-oriented approach is to be followed. In the following paper, the possible implementation is discussed and the question of a meaningful combination of online and face-to-face teaching is answered on the basis of the determinants that describe action-oriented learning-teaching arrangements. This response is intended to serve as a foundation for the implementation of hybrid, action-oriented learning-teaching arrangements and to inspire further discussion on the subject.

Keywords: *Blended Learning, fundamentals of electrical engineering, constructivist didactics, determinants.*

1. Introduction

The shift towards hybrid teaching, a combination of face-to-face and online learning, has emerged as a significant approach to making teaching in general and vocational schools as well as at universities learner-oriented, particularly in the context of the ongoing pandemic. The necessity for hybrid or purely online teaching during the pandemic was driven by the imperative to ensure the continuity of teaching activities. Consequently, the focus was often on rapid implementation, which hindered the development and evaluation of appropriate didactic concepts. A particular challenge exists in the area of vocational education, given its emphasis on the practical design of learning-teaching arrangements. In Germany, action orientation is an obligatory concept for the design of lessons at vocational schools, which at first glance requires direct interaction between students and the use of real artefacts. The following research question is the focus of this paper:

"How should face-to-face and online teaching be combined and configured to facilitate action-oriented learning and teaching arrangements that are conducive to learning?"

In order to provide a response to the research questions, it is first necessary to explain the theoretical context. In particular, Chapter 2.3 clarifies the special requirements of vocational education, since the determinants of such a (obligatory) teaching concept are explained here. Subsequently, possibilities are shown for designing hybrid teaching that takes these framework conditions into account, in order to be able to carry out action-oriented learning-teaching arrangements in a hybrid way. The individual considerations are always undertaken from an angle derived from constructivist learning theory, which is the reason why the paper refers to the term "learning-teaching" and not "teaching-learning" arrangements. In constructivism, learning processes are considered to be superficial and teaching processes to be supportive.

2. Theoretical framework

In order to provide a meaningful framework for understanding the individual proposals that facilitate hybrid, activity-based teaching, the term "hybrid teaching" is first defined below. This is followed by the subject-didactic positioning of the activities of the author of this paper and the definition of activity-based learning-teaching arrangements according to ten determinants.

2.1. Hybrid teaching

The term 'hybrid teaching' is generally used to describe the combination of face-to-face and online teaching (Olapiriyakul & Scher, 2006). However, the specific combination of these two options can vary depending on the target group, the available resources and other framework conditions (Graham, 2006). In the context of differentiating between face-to-face and online teaching, GRAHAM identifies several dimensions that allow for a more detailed distinction than the comparison of the two basic concepts. In his differentiation of teaching and learning forms, GRAHAM considers four dimensions: space (live vs. virtual), time (live synchronous vs. asynchronous), fidelity (high (rich all senses) vs. medium (e.g. audio only) vs. low (text only)) and humanness (high human vs. high machine) (Graham, 2006). A refinement of the distinction between face-to-face and online teaching is provided by ALLEN, SEAMAN and GARRET, who introduce distinct boundaries between the individual formats. According to this classification, traditional teaching (face-to-face teaching) is characterized by a complete absence of online elements, web-facilitated teaching by a proportion of 1-29% online elements, blended or hybrid teaching by a proportion of 30-79% online elements, and online teaching by a proportion of 80% or more online elements. In this context, a differentiation is made based on the content of the respective degree program (Allen, Seaman & Garrett, 2007), although this can also be applied to individual learning scenarios.

STAKER and HORN identify four fundamental models within the domain of hybrid teaching. In the rotation model (1), learners transition between learning modalities in accordance with a predetermined plan or based on the instructor's specifications, with an online component constituting a minimum of 30% of the total to align with the definition proposed by ALLEN et al. The flex model (2) offers learners enhanced flexibility by primarily delivering content online and enabling them to follow an individualized, customizable schedule. This flexibility allows learners to switch between learning modalities at their own preference. Another approach is the self-blend model (3), in which complete learning units or modules are available online. Learners have the option to combine these with other learning units, thus ensuring a high degree of customization of their learning activities. Finally, the enriched-virtual model (4) represents a combination of online and classroom teaching, whereby the overall school experience is maintained. This implies that learners usually commence their learning in the classroom, with the teaching enriched by online content. (Staker & Horn, 2012)

According to STAKER and HORN, the first model is particularly suitable for vocational schools, as it accounts for the legal requirement for compulsory schooling and the curricular guidelines. However, it is imperative to acknowledge that a proportion of 15% to 30% of online teaching in vocational schools is currently being discussed, thereby falling short of the criterion established by ALLEN et al. Consequently, the current situation merely permits the designation as web-supported teaching within the rotation model. Nevertheless, the present paper concentrates on the proportion of online teaching that falls within the range of 30% to 79%.

2.2. Constructivist didactics of electrical engineering

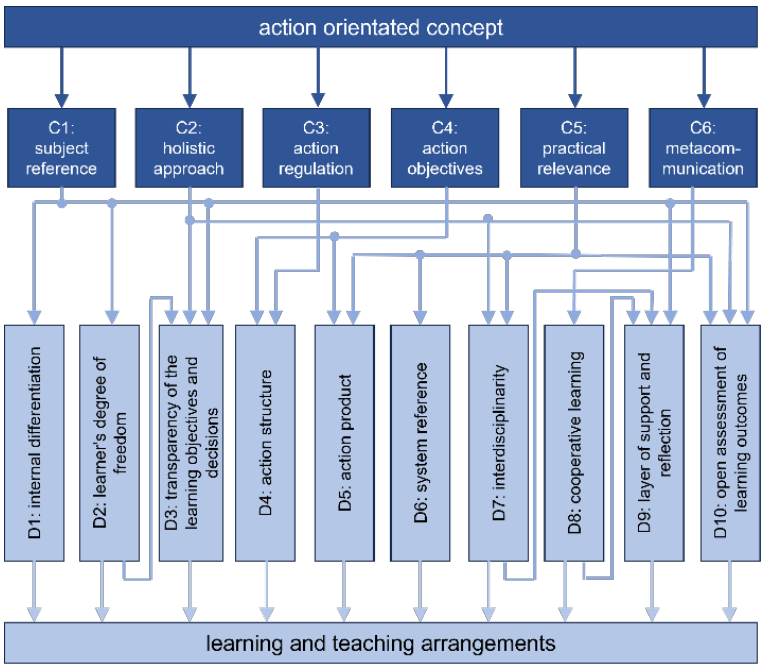
The constructivist Didactics of Electrical Engineering (cDoEE) (Jambor, 2022) serves as the foundational framework for the author's teaching and research activities. The cDoEE didactics emphasizes the fundamental principles of electrical engineering, which are distinguished by their abstract nature and frequent mathematical representation. This characteristic of electrical engineering presents a significant challenge for learners due to the complexity of the subject matter. The theoretical basis for these didactics is constructivism, a learning theory that emphasizes the active construction of knowledge by individuals. The cDoEE conceptualization of the human being is rooted in the Transactional Analysis of STEWART and JOINES, which rejects the notion of a fundamental hierarchical distinction between individuals and posits their capacity for deliberate decision-making and self-correction (Stewart, Joines, 1987). The application of these learning theories to learning-teaching arrangements implies a shift in responsibility for one's own learning processes to the learners, as well as a shift in the teachers' tasks to the area of support. The development of helpful and unhelpful preconceptions can be seen as a possible side effect of the learning processes, which is identified as one of the main aspects in cDoEE (Jambor, 2024).

The overarching objective of the cDoEE is to create a tool for selecting content and competencies for learning-teaching arrangements, as well as for planning these arrangements, taking into account both vocational training and the introductory phase of university degree programs. From this overarching objective, four intentions of the cDoEE are derived. The motivation of learners (1) for the often-abstract fundamentals of electrical engineering is a central success factor in the learning-teaching processes to be designed and should be encouraged. Furthermore, preconceptions (2) related to the fundamentals of electrical engineering should be counteracted, and the significance of subject knowledge (3) should be reinforced, given its particular importance in the field as a foundation for more advanced content. Finally, the development of inert knowledge (4) should be avoided, so that competence-oriented teaching is emphasized.

2.3. Action orientation

Action orientation is a fundamental concept in cDoEE, which is particularly salient in terms of its first and last intentions. This concept can be delineated in terms of characteristics (C1 - C6) and determinants (D1 - D10), as illustrated in Figure 1. These characteristics represent the comprehensive approach of action orientation and are derived from constructivist learning theory. However, the inherent abstractness of these characteristics renders them only marginally suitable for delineating an action-oriented learning-teaching arrangement. To address this limitation, the characteristics are thus substantiated and described in the form of determinants. These determinants can be utilized not only as a reference framework for planning but also for evaluation, thereby facilitating reflection on the implementation of the learning-teaching arrangement. A comprehensive presentation of the characteristics and determinants can be found in JAMBOR (2024), so that only the determinants are outlined here for reasons of scope and relevance.

Figure 1. Characteristics and Determinants of Action Orientation.



The determinant "inner differentiation" (D1) prioritizes the consideration of individual learners and their prior knowledge, with a focus on addressing learner needs, individualizing the structural coupling between learners and teachers or the subject (Meturana, Varela, 1980), and, when necessary, practicing reframing to eliminate potential learning hurdles (Clark, 1998). The support provided to learners is not limited to the elimination of difficulties; it also encompasses the fostering of individual development, thereby creating additional scope for both learners as a group and as individuals. Consequently, this fosters further degrees of freedom for learners (D2) in the sense of self-control. To promote the feeling of being able to use these degrees of freedom and to enhance learners' motivation, it is crucial to establish transparency (D3) regarding the learning objectives and didactic decisions made by the teacher.

The learning process is predicated on the workflow of a skilled worker or expert. Skilled workers or experts begin by identifying a problem (phase 0). Then, they inform themselves (phase 1), plan their process (phase 2), make necessary decisions (phase 3), carry out the action (phase 4), check the result (phase 5), and reflect on their work (phase 6). This results in an action structure (D4) with six phases (phase 1-6), which is frequently cited in the didactic literature and has been expanded by the author of this paper to include the zeroth phase. The individual phases are inherently linked to an action product (D5), which can be a device requiring repair or a circuit requiring modification. The action product should be sufficiently complex to promote system reference (D6) and to enable interdisciplinary links to other disciplines (D7), such as economic or ecological considerations. System reference promotes the problem-related structuring of knowledge within the learning process and counteracts the accumulation of inert knowledge (chapter 2.2.; 4th intention of cDoEE). Furthermore, the complexity of the action product necessitates cooperative learning (D8), thereby facilitating the alignment of cognitive structures among learners. During these activities, educators must establish a layer of support and reflection (D9). The three main components of the teacher's activity within this layer of support are as follows: classroom management (e.g., designing the

learning environment by setting rules; establishing routines that promote learning), cultivating a positive error culture in which errors are recognized as learning opportunities, and methodological support. The creation of process-related opportunities for reflection is subsumed under the layer of reflection and can be implemented, for example, through learning diaries and selective reflection discussions. Finally, the establishment of open assessment (D10) options emerges as the pivotal element in ensuring that action-oriented learning-teaching arrangements transcend the confines of mere selective knowledge queries and that learners are evaluated beyond the confines of their mere knowledge. Instead, the objective is to implement outcome- and process-related performance assessments and to engage learners in the evaluation process.

3. Action-oriented realization of hybrid learning and teaching

The individual determinants have been defined with a focus on implementation as face-to-face teaching; therefore, it is important to consider how hybrid implementation can be carried out without having to dispense with the individual determinants or to define them differently for hybrid teaching. With regard to the first determinant (D1), hybrid teaching opens up the possibility of providing learners with enhanced individual support, since learners can access individually adapted learning materials at their own pace online. Moreover, the temporal decoupling of learning and teaching processes enables the addressing of any difficulties that arise and the preparation of additional sources of information, thereby expanding the spectrum of learning opportunities for learners and increasing their individual degrees of freedom within learning processes (D2). Consequently, both media and methodological options can be utilized more comprehensively, thus allowing for the consideration of learners' individual learning preferences. In this context, the third determinant (D3) assumes even greater significance, as the selective decoupling of learning and teaching processes necessitates the assurance of transparency in learning objectives and teachers' decisions regarding learning modalities. This implies the continuous availability of both the learning objectives and the rationale for individual content-related and methodological decisions.

The phases of online and face-to-face learning can be arranged on the basis of the action structure (D4), which ensures a systematic and comprehensible transition between these phases. It is also possible to conduct individual phases of the learning process both online and face-to-face. For example, the first part of the implementation phase can be completed online with the aid of a simulation, and the second part of the phase can be conducted in face-to-face sessions using models and experiments. In either scenario, a deliberate transition between learning modalities is crucial. Ideally, this transition would occur within structured sequences, such as those that synchronize learners' learning statuses, address emerging questions, and define subsequent tasks. However, it is important to note that these transitions do not constitute actual phases in the sense of action orientation. Instead, they are intentionally designed to facilitate a seamless and structured transition between learning modalities.

The combination of the two learning modalities initially poses a challenge for the following two determinants, especially when the action product (D5) is used as a model in face-to-face learning phases. The possibility of establishing a system reference (D6) is to be assessed as positive with this real type of implementation, since learners do not focus exclusively on individual elements and contents, but grasp these in the context of entire devices and systems. The extension of models to encompass digital twins facilitates the utilization of devices and systems within both learning modalities, facilitating a transition from the device to the system level, and subsequently to the individual content. An audio amplifier, available in both model and virtual twin forms, can serve as a demonstrative example. Learners have the opportunity to work virtually from the amplifier as a whole, dividing it into individual assemblies (e.g., control unit, power supply) and then into the basic circuits used (e.g., voltage divider in the power supply). This enables them to consciously perceive the significance of the basic voltage divider, which may be considered abstract, in the context of system reference (D6). Subsequently, the voltage divider is examined through measurements in the amplifier and simulations in virtual space. The digital twin can also be utilized to consider ecological and economic aspects, fostering interdisciplinary work (D7). The spatial and, in some cases, temporal decoupling of learning activities necessitates the promotion of communication and collaboration through cooperative learning (D8). The integration of learning platforms and other digital tools, even in face-to-face settings, is crucial to ensure a seamless transition between learning modalities and to avoid overloading transition sequences with content that is more effectively viewed within individual modalities.

In the implementation of the omnipresent layer of support and reflection (B9), which is introduced in cDoEE to supplement the action structure, it should be noted that the temporal and spatial distance between the learner and the teacher also plays a role. With regard to the layer of support, the establishment of routines should be mentioned first, as they are considered an important part of designing the learning environment. These routines encompass, for instance, the discussion of questions, the articulation of

learning objectives, and the summarization of the most pivotal learning outcomes. The establishment of these routines must be meticulously trained and practiced in both face-to-face and online settings. Moreover, a positive error culture assumes even greater significance in online contexts, where individual errors and unhelpful preconceptions can be systematically logged and assigned to specific learners. This can lead to learners being reluctant to participate, so a stronger focus on mistakes as potential learning opportunities and their communication are required. The interpersonal relationship on which the interaction between learners and teachers takes place is becoming increasingly important because it has a decisive influence on learning success. In the context of hybrid teaching, where learners are entrusted with a greater responsibility for their own learning processes compared to conventional learning-teaching arrangements, systematic support becomes crucial. This is particularly pertinent in navigating challenges during online phases. Incorporating methods that promote and encourage prompt, continuous, and deliberate reflection is imperative within the framework of this layer of reflection. Learning diaries, portfolios, and one-minute papers are particularly suitable for reflection during learning. Finally, open assessment of learning outcomes (B10) can and should also be used to reflect on one's own learning activities, which proves to be particularly useful when it is used as a further opportunity for reflection in the sense of a positive error culture.

4. Summary and outlook

In addressing the research question, the preceding chapter delineates the potential for designing hybrid teaching methods in an action-oriented manner within the context of vocational education. It is demonstrated that the determinants and corresponding characteristics can be realized in hybrid settings. However, given that this is a conceptual framework and a basis for future discourse, subsequent research endeavors will undertake a more profound theoretical substantiation, along with the methodological implementation and evaluation in the context of studies involving learners.

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