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TEACHING EXPERIENCE - IMPROVING TEACHER EDUCATION WITH EXPERIENTIAL LEARNING

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ABSTRACT

At the basis of all current theories of experiential learning, action-oriented learning, student activation and similarly related principles, lies one simple truth: Human beings learn better when they can act and discover new facts for themselves. The value of hands-on learning is no longer in any real doubt, and it is being increasingly implemented in various school types and grade levels. However, when it comes to teacher education, many countries still continue to educate overwhelmingly in the "academic" style -- students sitting in a lecture hall or seminar room and listening to (or, in the best case, discussing) ideas and theories of how to teach. Drawing on several small-scale studies of different school types and age groups in Germany, this paper will show the pressing need to implement hands-on learning during university teacher education. After all, we cannot expect teachers to teach what they do not know themselves.

Key Words: Experiential Learning, teacher education, Germany.

INTRODUCTION

In the last 35 years, there has been substantial research done on the effectiveness of learning models that involve learner activation. Under titles such as "experiential learning", "active learning", "task-based teaching" and a variety of related monikers, theories and models of learning have emerged that establish the learner's activity as the central tenet of any learning/teaching environment. Regardless of their exact title, these theories are all based on a similar principle: that students learn effectively, and retain that learned information best, when they are actively involved in the learning process -- that is to say, when they are motivated to act and to discover facts and connections for themselves by being presented with complex tasks that require autonomous problem-solving.

There are numerous empirical studies in the English- and German-speaking academic communities showing the effectiveness of this type of learning. Admittedly, the results are mixed as to whether students actually learn *better* in the classical sense -- that is to say, whether they achieve higher results than students who are taught in traditional, instructor-centered formal classrooms. Some studies claim that students who learn under these conditions learn more and achieve higher results than their counterparts; others claim there is no appreciable difference; still others say that the class average with these methods is lower than with traditional methods, but that the best students outperform the best students from traditional classrooms, suggesting that this method particularly supports students who are already strong learners (for an overview, see Frey 2002, 175-176, as well as Kolb's 2005 *Experiential Learning Theory Bibliography*).

Where the studies do agree, however, is that content learned in a experiential context, through self-discovery and practical application, is retained for far longer, and can be accessed and transferred far more readily than content learned from traditional lecture styles. Even studies that show no appreciable difference in the level of knowledge achieved as a direct consequence of experiential learning offer clear evidence of later content retention to a much higher degree than traditionally learned information -- weeks, months, or even in some cases years later (for example the now-classic Specht & Sandlin study (1991); for an overview of earlier studies, see Frey 2002, 183-184).

And yet, despite the wealth of information about the benefits of this type of learning, its use in education is still minimal; as Karl Frey notes in his (for the German-speaking world) seminal work on project-oriented learning,

> "Diese Absichten stehen als bekannte Selbstverständlichkeiten in fast allen Bildungsartikeln der Staatsverfassungen, in Schulgesetzen und Lehrplanpräambeln. Sie sind aber keine Selbstverständlichkeiten der Schulpraxis" (Frey 2002, 51).
> *These intentions are included as self-evident facts in almost every article of every national constitution that deals with education, in school bylaws and curriculum preambles. They are not, however, self-evident in practice in the classroom (Frey 2002, 51, translation mine).*

Comparatively little time in the classroom is given to student-directed learning, while instructor-centered methods of teaching are still the most common form of classroom activity -- as much as 75% of classroom time, according to some studies (Nuthall and Snook 1977, Hage 1985, Kanders 1997, as discussed in Frey, 2002).

Recognition of the division between personal experience and education, and of the need to overcome this divide, is one that goes back to the second half of the nineteenth century: to John Dewey in the USA, as well as to the Reform Pedagogy movement in German-speaking Europe. Dewey was one of the first to promote alternative forms of hands-on, practical learning as the best way to involve students in their own learning; even without the results of decades of remarkable neuro-didactic research to support his claims, he saw that students learned "better", retained the information and could apply it in new situations only when it held a connection for them to their world of experience (Dewey, 1938).

During the Reform Pedagogy Movement in Germany and Austria, many educators developed new schools based on similar ideas to Dewey's. Georg Kerschensteiner, to mention one of those whose ideas have survived and who parallel both Dewey and the modern discussion most closely, is often considered the father of modern German vocational schooling, and his firm conviction that tasks for students should have a practical aspect and should fulfill a useful function is as relevant today as it was 150 years ago. They should, through careful planning and consideration on the part of both students and teachers, be suited to the materials and the situation at hand. Otto Haase, another contemporary in the Reform Movement, supported this view wholeheartedly; in his writings about the "People's School" (*Volksschule*), he wrote that students should create something, bring a project to completion, and should certainly not sit back and memorize. Tasks that were based on artificial or staged situations appeared to Haase neither conducive to real learning nor truly beneficial for students (Frey 2002).

Since the era of Dewey and the Reformists , countless others have bemoaned the deficit of experience in education, have proposed new theories of education and methods of teaching to close the gap, have tested out new types of classroom interaction -- and yet, somehow, traditional teaching methods still dominate classrooms. The words of Paolo Freire, written some thirty years after Dewey and over forty years before today, still resonate today with painful clarity: "Education is suffering from narration sickness." (Freire 1970, 52).

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REASONS FOR THE DISCONNECT

With such a history, it is easy to see that the complaints of educators, students and prospective employers about the practical irrelevance of today's education system are neither new nor particularly surprising. What is surprising -- and perhaps disturbing -- is that, despite over a century of discussing the problem, of proposing new ways to eliminate it or to at least soften its impact, of studies and evidence repeatedly showing that the systems we have are inadequate for students' needs, their basic structure has not yet significantly changed. And this begs one very simple question: Why?

Any answer to this question must ultimately be a form of speculation. However, possible answers can perhaps offer ideas of where stumbling blocks lie in the way of change, and how they could be circumvented.

One possible answer can be found in the furor unleashed by the results of international comparative standardized studies, most notably PISA. In the field of education, we talk about the often-unhealthy pressure on students to succeed in competition with their fellow students; we have now managed to apply this pressure to entire national school systems through the international scorn and ridicule heaped on those countries who compared unfavorably to their neighbors.

Large-scale international examinations are only one level of this phenomenon of standardized testing; it is also to be found at national and regional levels with varying degrees of influence. Due in large part to this pressure to succeed -- a pressure, mind you, that educators and parents frequently decry in small-scale settings -- we have teachers and schools determined to prepare students for the test, raise scores, and prove themselves against their contemporaries (their rivals?) in other countries or districts. This results in that four-letter phrase "teaching to the test", which is clearly not in any way conducive to the sort of open, experiential learning that is lacking in our educational systems. Rather, teaching to the test promotes rote memorization, testing strategies, and sometimes in extreme cases, learning how to "game the system" to improve scores without improving students' minds or abilities at all. Standardized testing naturally has its uses as well as its problems, and the results can be valuable spurs for change; a critical look at the reaction to test results in the last 10 years, however, offers clear indicators of their role as a constraining factor in school practice.

There are, of course, also factors external to the educational sphere that place limitations on teachers and curricula. One of these is, quite simply, the exponentially expanding rate of new information in the world. In today's world, every day brings with it new discoveries, refutations, technologies, applications and perspectives. Our level of knowledge is, at the moment, roughly doubling every ten years, and this rate will most likely only increase in the coming decades (Melezniak 1999). This puts educators in the difficult position of having to decide what, out of this vast wealth of information, students actually need to learn in order to be successful in their later lives. 200 years ago, it was unthinkable that an educated person could leave school without at least a basic command of Latin; nowadays, we regard the ability to read Latin as an interesting, but not necessarily useful skill (except in some specialist disciplines and by those students who have learned Latin, of course). Today, we expect students to have a basic grasp of national history when they leave school; will that still be considered a requirement in 100 years, or will history be forced out to make room for new subject matter that students "need"? It is difficult to say. That schools in Germany would see the necessity of offering courses in computer science, or that schools in America would consider it an obvious course of action to offer Japanese classes, would have boggled imaginations only 50 years ago; today, these courses do not even garner a raised eyebrow.

Because of this ever-expanding knowledge base, teachers are faced with an ever-expanding curriculum. The definition of what students "need to know" is changing rapidly, and many times teachers see themselves forced to reduce lessons to little more than memorization and repetition of countless facts simply in order to

cover all of the prescribed material; there is little doubt that grasping the significance of facts takes longer and requires more depth than simple memorization without deeper understanding. Whether this sort of "learning" can or should be classified as beneficial to students is at best questionable; it has, however, been shown that this sort of learning is not easily available for students to transfer later and does not promote the sort of trans-disciplinary skills, such as critical thinking, decision-making and an active attitude towards learning, that are far more important for later life than, say, facts about the functions of mitochondria in cellular biology (to take one particularly dry example from my own high school career).

Whether these facts are more or less useful than critical thinking skills, however, is beside the point for most educators in day-to-day practice. As long as teachers are given state- or nationally mandated curricula with material that "must" be covered, they are forced to focus on fitting their given material into one school year -- and classroom practice will suffer.

Although certainly part of the problem, these factors are, however, not insurmountable. A far more fundamental problem, and the focal point of our research, can be found before educators ever reach schools -- that is to say, before they ever officially become educators. As Frederking (1998) pointed out while describing the limitations of language-arts teacher education, teachers can teach only in a manner, and will only initiate learning processes, that they themselves have experienced. Here is yet another piece of evidence to support experiential learning -- theory about teaching cannot be transferred to classroom practice without the practically applied experience to sustain it. More importantly, it points to a glaring hole in teacher education: future educators are themselves frequently not capable of teaching in experiential learning contexts because they have never experienced this type of learning environment during their education.

This complaint is by no means new either. That teacher education is split into theoretical, academically presented content and practical phases in schools, and that the two are rarely, if ever, connected to one another, has been decried by education experts for decades. Nearly every study that discusses student opinions or evaluations of teacher-education programs on both sides of the Atlantic, in fact, discusses this as the most frequent and most pervasive criticism by students (Schaefers 2002, Zeichner 2009). Zeichner even quotes Linda Darling-Hammond (2009) as referring to this disconnect as the "Achilles Heel of teacher education".

Multiple German students, when asked to describe their studies, discuss creativity-stifling seminars where the wisest course of action is merely to "sit out" your time so that you can fulfill the necessary requirements, receive credit, and move on. As one teaching student put it, "Die studentische Hauptbeschäftigungen während eines Seminars sind: Tratschen, Schlafen, Lesen von Illustrierten, vom Projektor oder vom Tafel Abschreiben [...], Kreuzworträtsel-Losen, für andere Seminare Texte vorbereiten usw[1]." (Frederking 1998, 220) Based on my studies, concluded almost 15 years later, I would add "writing on the Facebook wall of the person sitting two seats away from you" and "playing online games on a laptop or Smartphone" to the top of that list; despite these digital updates, however, the trend remains clear: learning, if it takes place, isn't happening in education seminars -- despite the help of the much-vaunted "new media" to which the majority of students now have access. Another student, discussing the impressions formed at the start of his program, points out, "Seminare [...] sorgten dann aber schnell für Ernüchterung. Schon nach wenigen Wochen wurde mir schmerzlich klar, daß die Lektüre eines pädagogischen Fachbuches in dem heimatlichen Zimmer bei weitem effektiver ist als der

[1] "The primary student activities during a seminar are: gossiping, sleeping, reading magazines, copying down what's been written on the board or from the projector [...], solving crossword puzzles, preparing texts for other seminars, and so on." (Frederking 1998, 220, translation mine)

Besuch solcher Veranstaltungen[2]" (Frederking 1998, 151). Several also specifically discuss the total lack of preparation offered by these seminars for later work in the classroom.

It would be easy to dismiss such observations as coming from a few discontented students, or perhaps to dismiss the problem as one affecting the German educational system, without being more widely applicable. Among those teachers and university instructors of my acquaintance who have experience with student groups from different countries, German students are admittedly notorious for not participating and for merely sitting out their classes; any one of those instructors will say that it is a Sisyphean task to motivate German students to make a contribution to a discussion, or even to nod or shake their heads in answer to a question. This must then, to some extent, relativize their complaints about the uselessness of seminars.

However, there is a structural problem here as well, one that cannot be traced back to the students. If these seminars are so constructed that students are given no other task than that of sitting around and (perhaps) copying information from the board or the overhead projector (an activity which has in any case declined sharply thanks to the introduction of uploadable, printable PowerPoint slides), then can we blame students for not taking an active role in these classes? Is it any wonder that these students later, when standing in front of their own classrooms, will conduct similar lessons? How can we demand student-centered learning in schools when we utterly fail to provide it for future teachers in universities?

Even American students, who, at the other end of the spectrum, are somewhat notorious for an excess of the participatory enthusiasm that German students lack, nonetheless complain about a lack of practical use for the information and knowledge they acquire in university seminars. As Darling-Hammond notes, "Traditional versions of teacher education have often had students taking batches of front-loaded course work in isolation from practice and then adding a short dollop of student teaching to the end of the program -- often in classrooms that did not model the practices that had previously been described in abstraction" (Darling-Hammond 2006, 307). Zeichner also notes that "prospective teachers are supposed to learn theories at the university and then go to schools to practice or apply what they learned on campus" and goes on to say that one of the "perennial problem[s] in traditional college- and university-sponsored teacher education programs has been the lack of connection between campus-based, university-based teacher education courses and field experiences" (Zeichner 2009, 90-91). The opportunity to gain theoretical knowledge of educational theory and teaching methods is provided; opportunities to practice are, while rarer and usually somewhat haphazardly distributed, also provided. What is entirely missing is the connection between the two, the interaction between theory and practice, and how one can be integrated into the other.

Here are two major structural deficits that appear common to the vast majority of teacher education programs on both sides of the Atlantic: the structure of university teacher education, and the lack of connection between that university education and practical experiences in the field. How, then, can these deficits be overcome?

CONSEQUENCES FOR TEACHER EDUCATION

Why the Simple Answer Isn't So Simple

The answer seems fairly clear -- a restructuring of education seminars to make them more practically oriented, together with much tighter integration of field experiences and academic content. Implementing this simple-sounding solution, however, involves a wealth of complications. Many of these complications are addressed by Zeichner (2009) and Darling-Hammond (2006, 2010), but most of them are familiar to teacher educators the world over.

[2] "Seminars [...] quickly took care of bringing us back down, however. After only a few weeks, it became painfully clear to me that reading a textbook on educational science in my room at home was substantially more effective than attending such seminars." (Frederking 1998, 151, translation mine)

It seems like an indisputable fact that students who wish to become teachers need practice in the classroom. Darling-Hammond points out that new teachers who have not had an opportunity for some type of student teaching and who lack relevant coursework leave teaching in their first year at double the rate of better-prepared new teachers with both (Darling-Hammond 2010, 37). Yet, for some reason, student teaching tends to form only a minimal portion of teacher education[3], and tends to be entirely disconnected from the academic content students are expected to acquire beforehand. The result is that field experiences usually end up being something of an afterthought, rather than an integral part of the curriculum.

Additionally, as noted by multiple authors (including the author of this paper), there tends to be a distinct information gap between universities and the schools in a community. Zeicher sums this up as follows:

> ...it is very common for cooperating teachers with whom students work during their field placements to know very little about the specifics of the methods and foundation courses that their student teachers have completed on campus, and the people teaching the campus courses often know very little about the specific practices used in the P-12 classrooms where their students are placed (Zeichner 2009, 91).

When students do have the opportunity to enter classrooms, what they see rarely corresponds to what they have learned in the university. Their mentors/supervisors in schools do not act according to the principles that their university instructors have emphasized as important, and student teachers in any case rarely have access to the thought-processes of their mentor teachers (Zeichner 2009, 91) and so must attempt to reconstruct the logic behind a lesson-plan (assuming there is one) for themselves. Also in many cases, student teachers are an additional burder for teachers who already have their hands full with a normal class schedule and little to no interest in actively examining their own teaching practice, as noted by several students in Frederking (1998). In the worst case, as described to one of the authors by colleagues at her former school, veteran teachers are occasionally actively hostile to student teachers who come into a settled environment with new ideas and new methods to try out, regarding them as troublesome upstarts who disturb the working order with the latest teaching fad. In such a situation, the information gap between universities and cooperating schools is not merely inconvient, but rather becomes an active source of problems.

In most teacher education programs, few attempts are made to bridge this gap, and when attempts are made, they most often involve university instuctors attempting to bring their expertise into schools to improve practice (Zeichner 2009, 90); the expertise of practicing teachers is here usually entirely neglected. One reason as to why is the simple, almost painfully obvious truth stated by Boud: "The practical and the applied do not tend to have the same status in educational instituitions as the academic and the abstract" (Boud 1989, cited in Hansen 2000, 24). This also explains the typically underrepresented and comparatively neglected proportion of teacher education given to student teaching -- academic teacher educators see academic teacher education as more important and more valuable than practical experience; therefore, it receives comparatively more time and attention during teacher education. That this is the case despite numerous bodies of evidence supporting experiential learning processes in general and the value of well-integrated student teaching in teacher education in particular, is a clear indicator of a necessity for change.

There are also structural barriers within university systems that make implementation of such far-reaching, well-coordinated programs difficult. Darling-Hammond (2006) notes such problems as the "challenges [to] traditional program organizations, staffing, and modes of operation", including "departmental divides,

[3] This is the case in the majority of full-time teacher education programs; many fast-track teacher programs, such as those common throughout Germany and the United States, put new teachers directly in the classroom after only a few weeks of coursework and entirely skip over any form of student teaching beforehand; it is assumed that these fast-tracked teachers will "pick up" what they need on the job or in seminars attended during their first two years of teaching.

individualistic norms, and the hiring of part-time adjunct instructors in some institutions that have used teacher education as a 'cash cow' rather than an investment in our nation's future" (Darling-Hammond 2006, 306). More problematic than existing structual barriers, however, is the inertia of years of of habit, which for many colleagues cannot be overturned overnight to create entirely new structures and systems. Schaefers (2002) discusses at length the fact that almost all of the instructors in teacher education freely acknowledge the deficits of the system and regard suggestions for improvement positively. As she also points out, however, only a very few trouble themselves with the enormous effort of actively implementing said suggestions; many others remain complaisantly indifferent.

A Less Complicated Solution

There are multiple solutions to this problem. Zeichner (2009) and Darling-Hammond (2006) describe programs designed to more closely connect schools and universities and to ensure that teaching students have the necessary support they need while adjusting to the classroom. Some universities have even established campus-based laboratory schools, where the principles described in seminars can then be directly modeled in the classroom, or professional development schools, which are specifically designed to teach concrete skills and provide students with the tools they need to be sucessful in the classroom. Many programs hold one or more methodolgy courses on-campus in elementary or middle schools in an attempt to bring teaching students closer to their future professional environment. Zeichner (2009) and Schaefers (2002) both briefly describe university courses which integrate co-current student experience in schools and how these courses directly connect student teaching experiences with the theoretical concepts learned in classes; both also discuss the overwhelmingly positive responses to these courses from student teachers.

Such programs are all excellent examples of possible measures to solve the problems in teacher education discussed above. Unfortunately, they all require a staggering amount of work to implement and demand intense and focused cooperation between community schools, their teachers, university-based teacher educators and program administrators (not to mention the teaching students themselves). The are also the absolute exceptions to the rule, with such programs being praised to the skies as innovative, creative, and making vast strides towards improving teacher education -- thus, as anomalies. While not impossible to overcome, the various factors involved in the creation and maintenance of such programs, as we have already discussed, can stymie even the best-intentioned reform efforts.

Another possible solution to this dilemma has been finding increasing prominence in Germany in the last few years: the integration of so-called "Schülerlabore" (literally: pupil laboratories) into the university teacher education curriculum. These laboratories provide an extrascholastic place of learning for students from primary school up to (in some cases) post-secondary vocational education where students can experiment and supplement the theoretical knowledge gained in school with practical, hands-on experiments. The labs are frequently attached directly to universities or museums, or they are community-based spaces that can work in cooperation with local universities; because of these affiliations, they typically have facilities which are substantially superior to normal school science labs as well as multiple staff members to supervise and support students, and they offer a variety of educationally prepared experiments and activities which can then be integrated into a normal school curriculum.

Various universities across Germany (as examples, we can mention here Braunschweig, Berlin, Heidelberg, Würzburg, and Paderborn) have taken advantage of the opportunities offered by these extrascholastic learning environments and have offered teaching students the chance to work as the supervising personell with school classes from different levels. In some cases, teaching students also have the chance to design the hands-on, student-centered experiments that are on offer in the labs, as well as supervising and assisting visiting school classes. This experience in the laboratories is then directly coupled with university supervision and, in many cases, a seminar specifically tailored to reflecting upon the teaching practice gained at the labs.

This approach has a variety of advantages in its implementation. Because most of these laboratories have a variety of experiments on offer, interested school teachers can select an experiment that fits into their school curriculum and can bring their classes to the labs at a convenient point in the school year (the majority of the experiments are designed with the state-mandated curricula in mind, so that it is exceedingly rare that an experiment is offered that in no way fits into a school year). This is in direct contrast to most school placements, where teaching students are arbitrarily placed in a school for a few weeks during the school year (most commonly during university vacations, which are not always the same as school vacations) and must integrate themselves into the already-exisiting lesson structure. Their cooperating teacher must frequently re-plan and redesign so that teaching students have a chance to hold their own lessons, and the lessons planned by the teaching student must then also be adjusted to fit not only the curricula, but also the level and conditions of a specific class.

The cooperating teacher is also expected to observe, evaluate, and offer feedback to the student teacher. No matter the circumstances, it is a rare student teacher who is not in some way an added burden to his/her cooperating teacher; whether that cooperating teacher is willing or even glad to provide this guidance and support is here beside the point. In the laboratory setting, the student teachers neither require nor expect help from the classroom teacher; the experiments are designed to be carried out by school classes, and the student teachers are there to aid as necessary, while the classroom teacher is welcome to participate or not, as he/she chooses. Observation and feedback regarding the student teacher can be provided by a university supervisor and/or other student teachers; if the classroom teacher wishes to offer comments, these are typically welcome and integrated into the rest of the reflections, but he/she is under no obligation to do so.

The laboratories also offer a secure space for teaching students to practice without worrying about consequences, which often necessarily accompanies such practice in schools. When in schools, there is often a good deal of pressure on the student teachers because of many of the factors mentioned above, such as time constraints, adjusting one's lessons to the curriculum, and the pressure of coming in as an "outsider" and a beginner into a community of teaching experts (not to mention the fact that, should everything go horribly wrong, the student teacher will frequently still have a week or more of their internship with the same classes and colleagues who have witnessed said failure). In the lab, student teachers have the chance to gain experience with school classes from all levels and school types in a low-stress environment, where their teaching role is designed to be one of helper and facilitator, rather than as the source of knowledge and the director of all activity (as is the structure of many school lessons). By the very nature of repetitive practice, or due to the fact that the students have designed the lessons themselves, they are also frequently comparative experts on the topic being presented, which is not always the case when teaching one-off lessons in schools on a subject demanded by the curriculum and by the time of year. As the classroom teachers have sought out the particular experiment that their classes will take part in, student teachers do not have to consider how or whether it fits into the curriculum; as they are not familiar with the class or with what the class has done until that point in the year, they are also not responsible for designing a lesson to correspond exactly to what has been done in the classroom. Admittedly, this last point can be a disadvantage in that the knowledge and skills of the participating class are also unknown. However, well-designed experiments based on principles of task-based or experiential learning should cater to a variety of ability levels, and student teachers thus receive a chance to see the variation between different classes or different schools that are ostensibly at the same "level". And, should everything go horribly wrong, they can be comforted in the knowledge that the class and the accompanying teacher will disappear at the end of two hours. They can then analyze what went wrong in detail with the university supervisor and their peers, what could be improved, and then try again with an entirely different class with whom they have no negative history.

It goes almost without saying that, in addition to the advantages for student teachers that set laboratory experience apart from school-based field experiences, there is also the advantage, similar to school-based student teaching, of gaining concrete experience interacting with a broad variety of classes from different

levels and school types and having a chance to put the didactic concepts learned at the university into practice. Almost without saying -- but not quite. The importance of classroom (or, in this case, laboratory) practice cannot be emphasized enough. In this setting, the student teachers also have the time and necessary mental space for the complete cycle of planning -- teaching -- reflecting that is crucial for long-lasting and signficant learning. They have the time and opportunity to plan their actions, to put that plan into action, to reflect on the experience, and then to let the results of that reflection flow into the next round of planning and action, thus supporting their learning in exactly the ways that have been shown, both through studies on experimental learning and from students' own accounts, to be most effective.

In addition to the advantages for student teachers, there are also advantages for university programs in such a concept. Rather than entirely restructuring their teacher education programs, the supervision and/or construction of units for the labs can be integrated into existing didactic requirements -- in the case of the German system, this can be integrated into the content pedagogy courses required of all teaching students, as in the examples we will look at shortly. This also has the added advantage of making the didactic concepts under consideration subject-specific; a didactic seminar for future chemistry teachers, for example, can focus on didactic concepts that are particularly well-suited to chemistry lessons and to the age groups of those students most likely to have chemistry as a school subject.

The problem described by Schaefers (2002), that very few instructors are typically willing to make the effort to implement substantial changes to the university curriculum (although many regard such attempts with uninterested approval), does not apply here, for the simple reason that not all university instructors would have to participate in such a program concept. Only the motivated few would be required, in order to offer the accompanying seminar and to provide the supervision and feedback of a university advisor -- and, since the accompanying seminar could be integrated into exisiting didactics courses, the effort required would not that much more appreciable than current offerings require.

The massive coordination efforts between school and university are also substantially softened when this interaction is mediated by the laboratory. The classroom teacher is not required to supervise or offer feedback to the student teacher, so there is no pressing need for him/her to know what is being done in the university coursework; if his/her teaching does not model the practices or theories desribed in the seminars, it makes no difference to the student teacher who does not see it. The student teachers are not observing a classroom, where there may be little, if any, resemblance to the practices described in their seminars; rather, they themselves are teaching and can concentrate on putting their theories into practice.

Coordination between schools and the laboratory is essential, of course, so that classroom teachers take advantage of the opportunities offered by the lab; however, this coordination is often easier to secure than more extensive cooperations, primarily because it represents a one-time experience for a class, rather than weeks of accomodation. Many more teachers are glad to trade one afternoon in return for an extraordinary experience for their class than are glad to re-adjust their lesson plans, teaching styles, and time management for three to four weeks on end, or every Thursday for half a year. In addition, in many cases the laboratories offer facilities, equipment, or materials that are simply not available in schools, thus providing an additional draw for teachers in the chance to carry out activities they could not under normal circumstances. (For an overview of studies done on classroom teachers' opinions of visits to extrascholastic learning environments, see Klaes 2007.)

Although there are some disadvantages to this model, a few of which we have addressed here, they are far outweighed by the obvious advantages -- for teaching students, classroom teachers, and university program instructors and administrators. More importantly, here is a comparatively feasible way to close (or at the very least materially narrow) the perennial gap between theory and practice in teacher education via experience in the field, in direct interaction between student teachers and the classes they will later teach.

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PILOT PROGRAMS

As mentioned in the last section, this is a concept that in the last few years has gained and is still gaining popularity in Germany. This is due in part to the popularity and prevalence of extrascholastic learning labs in that country (for an overview of German learning labs, see www.lela.de), but even when labs are not available or when they do not fit the desired requirements, universities have created their own to serve the needs of student teachers (for example in Braunschweig and Paderborn). In an effort to show what such programs could look like, some of the existing pilot concepts from German universities will be briefly introduced here.

Würzburg

The University of Würzburg is home to the "MIND-Center", an interdisciplinary coordination point for teacher education and education research. Within the MIND-Center, various subject-specific didactic departments, such as chemistry, computer science, and biology, have congregated around the focal point of the center: the Teaching-Learning-Lab (Lehr-Lern-Labor), also known as L^3. This is an extrascholastic learning lab such as we have already described, in which school classes can carry out experiments on a variety of topics. They are supervised and aided as necessary by student teachers from the university.

Within the physics department[4], all teaching students are required to take two courses related to the L^3, one for subject-specific pedagogy and one that directly accompanies a stint working in the lab. These two courses are intended to take place in subsequent semesters, meaning that students receive the theoretical basis that they need in their pedagogy course, such as teaching methods and theories of learning, and can then directly apply these theories in the following semester in the lab. The students either develop the experiments for the lab themselves, or they can modify and optimize existing units. The student teachers then accompany classes or small groups of students roughly 6-12 times over a period of 1-3 weeks as they carry out the experiment. Directly after each round, they receive concrete feedback on their teaching style, their integration of the methods and theories discussed in class, and their interaction with their group, which they can then reflect on and apply in their next round of teaching.

Particularly important hereby is the fact that the experiments are designed so that the participants should be able to complete them *without* needing extensive help from the student teachers. This means that, not only do student teachers gain valuable experience in interacting with school students when they do help, they also gain valuable experience in how to keep themselves in the background -- not only gaining through their own experiences, but learning how to make experiential learning possible for their classes later on. In the case of the MIND-Center, teaching students are confronted with classes from all different age groups and school types, thus providing them with an opportunity to gain experience across a broad spectrum of possible learning types.

The stated goal of this concept is an improvement in the professional competence of the teaching students, and the results from the first preliminary studies of the L^3's impact have consistently been positive (Völker 2011). In feedback evaluations, students specifically cited the practical relevance of their work in the lab for their future profession and the fact that the transfer of theory to practice is not to be learned in the academic classroom alone. Via a self-evaluation, every single one of the students estimated their own "teaching competences" (for example, time management or creating worksheets) as being markedly improved at the end of the seminar, and every one assessed the seminar as a distinct possibility for improving the quality of teacher education.

[4] All descriptions of the L^3 and the course of studies described here go back to Völker and Trefzger (2010/2009). The descriptions here refer to the newer modularized program and not to an earlier version of the seminar/lab cooperation, although the two concepts are similar.

Heidelberg

Somewhat differently organized, but with a similar goal, is the work done in the science-live! laboratory in Heidelberg in cooperation with the Pädagogischen Hochschule. Here, teaching students (also from the hard sciences) spent up to 2 years wroking in science-live! with groups of students. Here, in an effort to extend the princples of creative problem solving and experiential learning the participants could to some extent design their own activities, so that more support from the teaching students was required; this, of course, highlighted the student teachers' ability to step back and allow the participants to experience without input, as one of the focal points of the students' theoretical training. The student teachers were expected to provide methodological and expert support, but were strongly discouraged from otherwise directing the learners[5].

Their work was not directly connected to a seminar in the university; rather, each student teacher had intensive personal supervision from a university instructor and multiple evaluation and reflection points over the course of their work. They produced portfolios documenting their behavior, their opinions, and their beliefs about teaching, as well as the systematic reflections that had an effect on those factors. Additionally, their work in the laboratory was periodically videotaped to be more closely reviewed and analyzed together with their university supervisor.

At the end of the two years, the materials were analyzed to determine whether an increase in "professional competences", as defined beforehand (Leonhard 2008) had been achieved. Rather than relying on self-evaluations, Leonhard and his colleagues evaluated the students based on a validated competence rubric to determine whether such professional competences as reflection, self-control, and self-direction had improved over the course of their work. In order to validate the results, the materials were also given to colleagues familiar with the competence rubric but not with the study to see if the evaluations were comparable.

Because of the incredibly small sample size (n=3) and the mixed results from one subject to the next (and, to some extent, from one evaluation to the next), it is difficult to draw conclusions about the effectiveness of this concept. However, on a subjective level, every one of the student teachers involved rated the combination of work in the lab together with intensive supervision and reflection as highly effective -- much more so than their "regular studies". Leonhard points to an improvement in competence as well, but whether or not an improvement can be measured, it is clear that work in the labs provides valuable experience for students on an affective level, increasing their self-confidence in their own abilities as well as their ability to see the connection between work in a classroom setting and the reflection and theory offered in the university. It constitutes a decided improvement over the normal course of studies -- one that is highly regarded by the students.

Paderborn

In the Erfinderwerkstatt (Inventors' Workshop) of the University of Paderborn, a small extrascholastic learning lab located in the university, teaching students for vocational schools have the chance to plan and carry out teaching units for apprentices or students in full-time vocational education during two classes offered by the department for the Didactics of Technology. The students are asked to design tasks that offer experiential learning opportunities for the apprentices, and they then accompany and support the apprentices while they solve problem-oriented task descriptions.

The vocational school curriculum in Germany specifically describes task-based, experiential learning methods as the prescribed method to be used in vocational education and as an integral part of the educational mission of the modern vocational school. Therefore, the focus in the two courses specifically aimed at future vocational

[5] All information here about the science-live! lab and its work together with the PH-Heidelberg goes back to Leonhard (2008).

school teachers is on the principles of experiential learning and learner-orientation -- how teachers construct task-based problems that allow a variety of solutions, how to promote creative problem-solving on the part of the learners, and, most importantly, how to let learners learn and experience for themselves without falling back into a "traditional" teacher's role: that of a director of the action who already knows the correct answer. The teaching students can then directly apply the theoretical principles in the two seminars when constructing their own problems for apprentices; they later have the opportunity to try out their teaching units with apprentices from a local vocational school and afterwards reflect on and evaluate the experience. The principles of experiential learning are therefore at work here on two levels: on the first level, the student teachers have the chance to gain experience in their future profession and to interact with their future students. However, they are not only gaining experience for themselves; they are also actively learning how to facilitate experiential learning in others. Here we see student teachers experiencing the way in which they are later expected to teach -- a point which we have already cited as being one of the biggest deficits in current teacher education models.

As the teaching students will typically only have one, or at the most two, afternoons with the apprentices to carry out their planned projects, it is difficult to speak here of an improvement in professional competence (although it is perhaps worth noting that students subjectively evaluated the experience as contributing to such an improvement). Nonetheless, according to the feedback collected afterwards from the students in an evaluative group discussion and in reflection papers, the course was seen as a valuable building block in teacher education. Each of the participants discussed the relevance for their later profession, the highly effective nature of the theory-practice connection, and the utter dissimilarity of the course to the other didactic courses attended at the university. The unique nature of the course was, in fact, for many of the students the key factor; this course was seen as one of the only courses where theory was directly connected to practice and where the course itself had practical value and a direct bearing on their development as teachers.

SUMMARY OF THE RESULTS AND CONCLUSION

That experiential learning is one of the most effective methods of learning cannot reasonably be overlooked in the face of the overwhelming supporting evidence. That it is not an especially common method in the classroom is something that therefore *should* not be overlooked. Rather, we should be asking why this is the case and what can we do to change it and to encourage future generations of teachers to teach more effectively.

In the course of this paper we have focused on the theory-practice weakness in most teacher education programs as a probable cause for this deficiency. While there are undoubtedly many solutions to this problem, these solutions are also frequently necessarily constrained by the implications of implementation. In an effort to work around these constraints, we have proposed one possible solution, the use of extrascholastic places of learning, that is currently being used with notable success in universities across Germany and described possible forms that an implementation of this concept might take. Clearly, this implementation will also face its share of difficulties, and no solution is perfect; we have for the most part omitted a discussion of the deficiencies in the pilot programs (such as the difficulties of objectively "measuring" competences) due to time and space constraints. However, in light of the unwavering positive feedback from students, as well as the advantages of this solution discussed above, it still seems an entirely feasible option -- more so than many other more elaborate solutions.

Whether teacher education instructors and administrators decide for or against our favored solution, however, is unimportant. What is important is that the gaping cleft in teacher education between theoretical material in universities and practical experience in schools is recognized and that something is done to bridge it and to provide student teachers with meaningful learning experiences, so that they can later return to the classroom

and provide such meaningful learning experiences for their own students. In the end, we cannot expect future teachers to teach their students something they have no experience of themselves.

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