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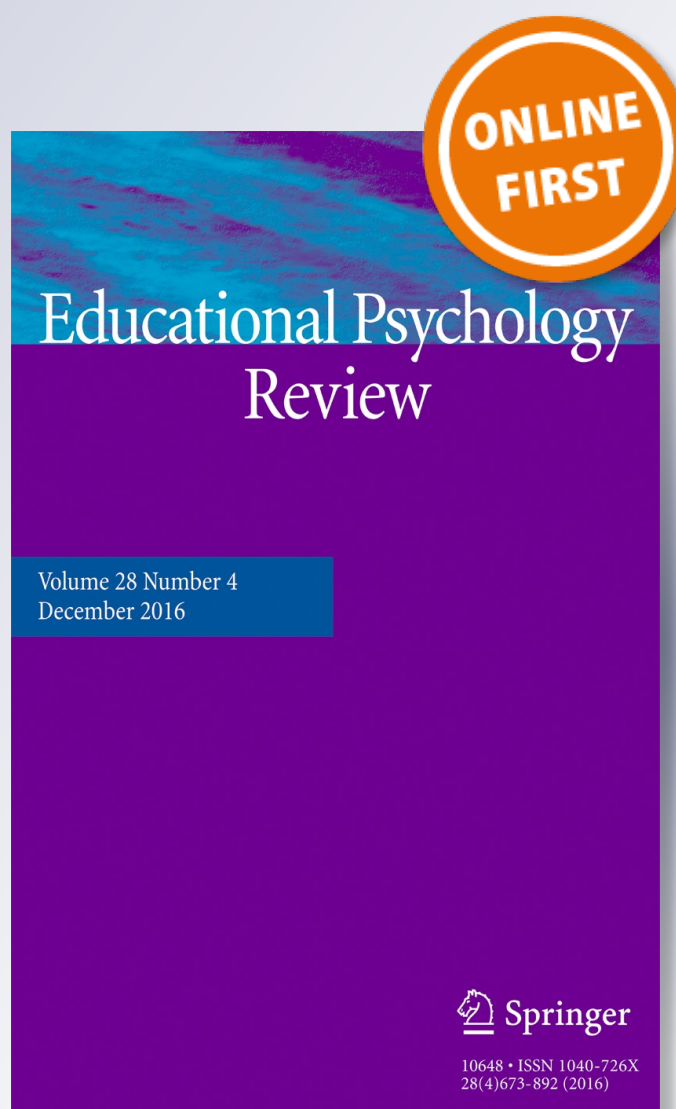
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Conversations with Four Highly Productive German Educational Psychologists: Frank Fischer, Hans Gruber, Heinz Mandl, and Alexander Renkl

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Abstract Previous research (Kiewra & Creswell, *Educational Psychology Review* 12(1):135–161, 2000; Patterson-Hazley & Kiewra, *Educational Psychology Review* 25(1):19–45, 2013) has investigated the characteristics and work habits of highly productive educational psychologists. These investigations have focused exclusively on American scholars who were trained and employed at various universities and have ignored international scholars and scholars with a shared academic lineage. The present study sought to fill these gaps by investigating, through qualitative methods, how a cohort of four German educational psychologists (Heinz Mandl, Alexander Renkl, Hans Gruber, and Frank Fischer) with a shared academic background became productive scholars. Interview responses suggested that the German scholars' shared experiences during the early years of their careers shaped their career paths and productivity. Additionally, interviews with each scholar revealed several commonalities (i.e., long and focused research career, trademark characteristic, scholarly influencers, effective time-management practices, and research-management strategies) between this contingent of productive German scholars and their productive American counterparts. Finally, the present study also identified several differences (e.g., educational training, funding opportunities, sabbaticals, administrative responsibilities, and research traditions) between the American and German research environments that influence productivity. Practical implications from this investigation include advice for emerging scholars.

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Introduction

In a 10-year period, educational psychologist Michael Pressley published 126 articles (Kiewra and Creswell 2000) and educational psychologist Richard Mayer published 150 articles, books, and chapters (Patterson-Hazley and Kiewra 2013). How is such high productivity possible? Some researchers have investigated research productivity quantitatively by compiling lists of productive educational psychologists based on publication data (Greenbaum et al. 2016; Jones et al. 2010; Mayrath 2008; Smith et al. 1998, 2003). Such lists, however, cannot explain why leading scholars are so productive. To find out, Kiewra and his colleagues (i.e., Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013) used qualitative methods. They identified and interviewed highly productive educational psychologists to uncover the secrets to their success. Findings offered insight into research productivity and advice for budding scholars (see also Kiewra 1994, 2008).

Review of Research on Highly Productive Educational Psychologists

In both studies investigating highly productive educational psychologists (Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013), educational researchers were surveyed and asked to list those who they believed were the most productive educational psychologists. The top 3 identified in 2000 (and their career publication totals at the time) were Richard Anderson (149), Richard Mayer (156), and Michael Pressley (211). Those identified in 2013 were Dale Schunk (123), Barry Zimmerman (179), Patricia Alexander (181), and Richard Mayer (356). The rankings of productive educational psychologists mentioned above (e.g., Greenbaum et al. 2016; Jones et al. 2010; Smith et al. 1998, 2003) corroborated these scholars' selection. Across these various studies, the scholars' highest rankings were as follows: Mayer, 1st; Alexander, 2nd; Pressley, 3rd; Zimmerman, 10th; Schunk, 12th; and Anderson, 12th.

Across the two qualitative studies (Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013), several defining characteristics emerged among the six scholars. All or most had (a) a long and focused research career, (b) a trademark characteristic, (c) scholarly influencers, (d) effective time-management practices, and (e) well-practiced research-management strategies. Each defining characteristic is briefly reviewed in turn.

Long and Focused Research Careers

High productivity levels were only accomplished over long and focused careers. Regarding longevity, most of those studied by Kiewra and colleagues (Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013) had careers spanning 30+ years (with Zimmerman's the longest at 45 years). The only small exceptions were Mayer (in 2000) at 25 years and Pressley at 20 years.

The highly productive educational psychologists also had research agendas that often included two phases: investigation of a basic research domain followed by focused and long-standing investigation of a signature research domain (Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013). For example, Anderson first investigated the basic

domain of verbal learning (e.g., Anderson and Pichert 1978) before conducting his signature and long-standing research on aspects of reading (e.g., Anderson et al. 1991). Zimmerman first investigated the basic domain of social learning (e.g., Zimmerman and Rosenthal 1974) before conducting his long-standing signature research on self-regulation (e.g., Zimmerman 1989). And, Mayer first investigated the basic domain of problem solving (e.g., Mayer 1975) before conducting his signature and long-standing research on prose learning (e.g., Mayer and Gallini 1990). In essence, the initial research domain served as a training ground for acquiring research skills and as a catalyst for identifying the signature area.

Trademark Characteristics

Each productive scholar had a trademark characteristic that was instrumental to productivity (Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013). For example, Anderson was an “enculturator”—skilled at developing a graduate student apprenticeship program that fostered student productivity and that of Anderson. Mayer (in 2000) was a “systematizer”—skilled at developing and carrying out a highly programmatic research agenda that explored meaningful learning across various (a) learning outcomes, (b) instructional variables, (c) learner activities, and (d) learner characteristics, and (in 2013) an “extender”—skilled at extending his research program through a variety of educational delivery systems such as text, animation, multimedia, and games. Alexander was an “assembler”—skilled at jointly investigating the disparate topics of knowledge development, strategic processing, and motivation through her Model of Domain Learning. And, Pressley was an “interconnector”—skilled at connecting research, teaching, and service so that effort in one area paid dividends in the other areas too.

Scholarly Influencers

The productive scholars had impressive lineages or important influencers (Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013). Anderson’s lineage, for example, traces back through such psychology luminaries as John B. Carroll, B. F. Skinner, Edwin Boring, and Wilhelm Wundt. Both Schunk and Zimmerman were influenced by Albert Bandura, a legendary social psychologist. Bandura guided them as they applied his social learning concepts to education. As a student, Pressley was most influenced by Benton Underwood, John Flavell, and Joel Levin. Productive American scholars also developed professional relationships outside their home universities. This finding aligned with creativity research (Gardner 1993) demonstrating that those with budding talent often gravitate to centers of excellence where they might work with top performers and other budding stars. Such was also the case for productive educational psychologists (Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013). Pressley, while still a student at Minnesota, gravitated to the University of Wisconsin to work with Joel Levin. Pressley later in his career spent three summers conferring with scholars at the Max Planck Institute for Psychology and Education in Munich, Germany. All of the productive scholars gravitated to elite institutions for graduate training and for professorships. Anderson, for example, gravitated to Harvard for rigorous graduate training and to the University of Illinois for his academic post where he could collaborate with a host of researchers who, like him, were interested in prose processing.

Time-Management Practices

Most of the productive scholars were fairly regimented in their daily routines (Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013). Anderson, for example, woke promptly each day at 5:25 a.m. and began the day with exercise. He arrived at the office at 8:30 a.m. each day. Mayer's routine involved breakfast with his wife each morning, driving his daughter to school, and arriving at the office at 8:30 a.m. He worked in his office with the door closed in the morning; lunched with colleagues; and then met with students, taught, or attended meetings in the afternoons. Dinner was at 6:00 p.m. and followed by a walk or bicycle ride. Evenings were for relaxation and some journal-editing work.

Most scholars worked about 50 h/week with about half that time devoted to scholarship. Like Mayer, most preserved the morning hours, when they were freshest, for research and writing activities and pushed less pressing activities such as teaching and meetings to the afternoon. Pressley and Alexander, who were colleagues at one point, were less structured and more obsessive about work than the others. Neither slept well and often worked late into the night. Pressley napped briefly when the family went to bed and then awoke to write for a few more hours before finally retiring to bed.

Research-Management Strategies

The American scholars (Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013) lived and emphasized the maxim, "There are no good writers, only good revisers." They recounted how they revised manuscripts dozens of times and sometimes spent more than a year nursing a manuscript to publication. Mayer also emphasized that both good research and good writing focus on a single issue or question. He said, "Having a lot of extraneous material is what confuses people" (Patterson-Hazley and Kiewra 2013, p. 32). Both Mayer and Anderson also stressed clarity in writing. Anderson said:

I work at the clarity of making the argument stand out, but when I find that it isn't standing out, that may mean the thinking behind it is murky. I like writing that has some interest but first it must be clear before it is appealing and interesting (Kiewra and Creswell 2000, pp. 151–152).

The scholars' writing practices were also influenced by their research focus (Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013). Mayer, an expert in adjunct aids, stressed the importance of including adjunct aids like signals, organizers, and concrete examples in his scholarly writings to aid comprehension. Zimmerman and Schunk, experts in self-regulation, naturally emphasized self-regulatory writing practices such as creating a planning matrix to guide writing and generating evaluation questions to assess it.

Alexander, meanwhile, ignored writing conventions when she composed. She preferred to let writing, "flow, flow, flow as rapidly as it can flow" (Patterson-Hazley and Kiewra 2013, p. 33). Editing, she believed, is preserved until after the ideas are revealed. She said, "People who try to edit sentence by sentence are constrained. It is almost like having constipation. You need to let the ideas out" (Patterson-Hazley and Kiewra 2013, p. 33).

Deliberate writing strategies were not the only methods that American scholars used to produce high-quality manuscripts. All of the productive educational psychologists agreed that student-faculty collaboration allowed them to be more productive than publishing alone, and

all of them collaborated extensively with students (Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013). Mayer and Schunk collaborated with students on about half of their publications; Zimmerman, Anderson, and Alexander collaborated with students on about three quarters of their publications; and Pressley collaborated with students on about 85 % of his publications.

The productive educational psychologists (Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013) attracted and recruited talented students. Once students were in the fold, they joined research teams led by the senior professor who met with the team and with individuals on a weekly basis. As students gained more experience, they gained more responsibility and shared increasingly in the plums of publication.

Collaboration, though, was a two-way street. Students did not simply work in the domains of the productive scholars. The productive scholars made sure that students found their own research niches and explored their own research questions as well. Regarding that two-way collaboration, Pressley said, "Graduate students took me into things that I wouldn't have gotten into otherwise. We explored these things together and cut some paths that neither of us would have found otherwise" (Kiewra and Creswell 2000, p. 153).

The Present Study

The research by Kiewra and colleagues (Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013) offered insights into the characteristics and behaviors of highly productive educational psychologists. Still, like most research, there were limitations that opened potential avenues for further research. The present study identifies and addresses two limitations of that research.

One limitation was that all of the productive educational psychologists investigated were American born, educated, and employed. It is possible that different educational systems differentially affect productivity. To begin examining this cross-cultural factor, the present study investigated highly productive German educational psychologists. German scholars were chosen, in part, because of their different (from American) system for attaining a full professorship. Whereas American scholars commonly earn a Ph.D. and then ascend the professorial ranks from assistant to associate to full professor, often at the same university, such is not the case in Germany. In Germany, a student earns a Ph.D. and then completes a habilitation, which is akin to a second Ph.D. Usually, scholars write their habilitation (an opus magnum or several scientific publications of outstanding quality) while employed as assistants of professors for several years at an academic institution. Once the habilitation grade is achieved, the scholar can apply for professorships at a different university. These full professorships are limited, and competition for them is steep.

A second reason for choosing to investigate international scholars, in general, and German scholars, in particular, is their emerging presence in American-based journals. According to Greenbaum et al. (2016), there is an increasing trend for the most highly productive educational psychologists to emanate from institutions outside the USA. In a 1991–1996 analysis (Smith et al. 1998), 15 % were from outside the USA. That number increased to 32 % in a 2003–2008 analysis (Jones et al. 2010). In the latest analysis (2009–2014), Greenbaum et al. (2016) found that 84 % of the most highly productive educational psychologists were from

outside the USA. Among the non-US institutions represented, Germany was the country most represented and by a wide margin over Canada, UK, France, and others.

A second limitation of previous research (Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013) is that all of the highly productive educational psychologists investigated were largely independent from one another. They were trained and employed at different institutions. No research has examined productive scholars who are academically linked. To begin examining this academic linkage factor, the present study investigated four scholars who were trained or employed simultaneously at one elite German research university: Ludwig-Maximilian University Munich. Research confirms that such centers of excellence are instrumental in the development and productivity of its members (Gardner 1993).

The present study, then, was similar in purpose to those conducted previously by Kiewra and colleagues (Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013). The purpose was to explain how highly productive educational psychologists become so productive. The present study differs from previous ones, however, in that it investigates (a) German scholars (instead of American scholars) to determine if cultural factors are at play and (b) a cohort of scholars (instead of independent scholars) to explore how such academic linkages influence productivity.

The present study, like those before (Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013), used a qualitative, case study approach to develop an in-depth understanding of how a contingent of German educational psychologists became highly productive. Case study research provides an in-depth understanding of a real-life, bounded system over time (Creswell 2013a; Merriam 2009). For the present study, German educational psychologist Heinz Mandl and a cohort of his highly productive protégés (Alexander Renkl, Hans Gruber, and Frank Fischer) represented the bounded system under study.

Methodology

Participant Selection

Extraordinary individuals generally do not develop in isolation from one another (Gardner 1993). They are often associated with centers of excellence where they work in close proximity with other aspiring and established experts (see Colvin 2008; Syed 2010). Because centers of excellence play a vital role in the development of expertise, the present study sought to identify a collection of highly productive international educational psychologists who shared a common center of excellence.

German scholars were selected because of their increasing recognition as productive educational psychologists (e.g., Greenbaum et al. 2016; Jones et al. 2010; Smith et al. 1998). Heinz Mandl, Alexander Renkl, Hans Gruber, and Frank Fischer were specifically selected because of their shared academic lineage at Ludwig-Maximilian University Munich (LMU) and their high scholarly productivity.

Table 1 provides an overview of each scholar's shared background in Senior Professor Mandl's research group. Mandl employed Renkl and Gruber in his research group while they completed their habilitation theses at LMU, and he served as Fischer's doctoral advisor at LMU during part of that same time period. Furthermore, Renkl and Gruber acted as peer mentors for Fischer during their shared time in Mandl's group.

Table 1 Time spent in Mandl's research group

1991	1991	1995	1997	1998	2001
Mandl begins research group	Renkl and Gruber arrive for habilitation	Fischer arrives to complete doctoral work	Renkl completes habilitation. Fischer completes doctoral thesis	Gruber completes habilitation	Fischer completes habilitation

Regarding productivity, Table 2 reveals the scholars' high publication volume that ranges from Fischer's 163 total career publications to Mandl's 461 through 2015. When these publication totals are divided by each scholar's career length, the following average annual publication rates are derived: Mandl, 12; Renkl, 10; Gruber, 10; and Fischer, 9. These annual output rates compare favorably with the average yearly outputs of Richard Mayer (8), Patricia Alexander (4), Barry Zimmerman (4), and Dale Schunk (3) reported by Patterson-Hazley and Kiewra (2013). Furthermore, Table 3 shows that the German scholars publish books and journal articles at a rate similar to the American scholars. The number of articles published by Mandl (123) and Renkl (154) at the time of this study, for example, is comparable with that of Alexander (173), Zimmerman (165), and Schunk (107) when they were studied. Furthermore, the total number of books and book chapters published by Mandl (338), Renkl (89), Gruber (168), and Fischer (94) shows that these German scholars place much more emphasis on these publication types than their American counterparts.

Taken altogether, Mandl, Renkl, Gruber, and Fischer possess the qualities sought in the present study. They represent a cohort of highly productive German scholars who shared a common academic background. Informed consent was obtained from all individual participants included in the study. All participants agreed to have their identities revealed as part of their participation in this study.

Data Collection

Previous qualitative research (i.e., Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013) found that productive educational psychologists tended to have (a) long and focused research careers, (b) trademark characteristics, (c) scholarly influencers, (d) effective time-management practices, and (e) well-practiced research-management strategies. A semi-structured interview protocol consisting of 26 open-ended questions was developed for the present study to reexamine these factors with respect to the selected German scholars. This interview protocol therefore contained questions related to research career (e.g., "What are your major research areas and how do they interrelate?"), trademark characteristics (e.g.,

Table 2 Total number of publications as of 2016

Publication type	Mandl	Renkl	Gruber	Fischer
Journal articles	123	154	87	75
Chapters	293	84	151	88
Books	45	5	17	5
Total	461	243	255	168

Table 3 Total publications of productive German and American scholars

	Mandl	Renkl	Gruber	Fischer	Mayer	Alexander	Zimmerman	Schunk
Articles	123	154	87	75	329	173	165	107
Books/chapters	338	89	168	93	27	8	14	16
Total	461	243	255	168	356	181	179	123

“What is your trademark characteristic, the one thing that that especially makes you productive?”), scholarly influencers (e.g., “How have other people, places, or things influenced your scholarly productivity?”), time-management practices (e.g., “What strategies do you use to increase work time or productivity?”), research-management strategies (e.g., “What are the helpful procedures you commonly employ for conducting research?”), and advice for emerging scholars (e.g., “What advice would you give for emerging scholars hoping to become productive?”). In addition, we asked whether there were any known differences in the American and German higher-education systems that might affect scholarly productivity.

Interviews were conducted with Mandl, Renkl, Gruber, and Fischer using the Skype™ online communication tool. Each approximately 2-h interview was recorded and later transcribed for analysis.

Data Analysis

Data analysis involved blending Creswell’s (2013b) principles of qualitative research with Yin’s (2013) case study approach. First, Creswell’s (2013b) preliminary exploratory analysis procedure was used to gain a general sense of the interview response data. According to Creswell (2013b), this initial step allows researchers to consider whether they need more data before moving forward with more intensive data analysis procedures. Two sub-steps were taken throughout this preliminary analysis. First, statements similar to findings from previous studies (Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013) were noted during the course of each interview and detailed summaries of each interview were created. Second, critical memos were written within interview transcriptions. Critical memos were brief summaries that captured the meaning or importance of a particular quotation or collection of quotations (Creswell 2013b). Reviewing interview summaries and critical memos helped determine that the point of saturation (Saumure and Given 2008) had been achieved and that no additional information was needed to describe the factors contributing to scholarly productivity.

Following this initial analysis, Yin’s (2013) cross-case approach to case study research was used to explore the productivity of this contingent of German scholars. In Yin’s (2013) approach, interview data are collected from a small number of participants and analyzed to explore similarities and differences in their experiences. In the present study, a cross-case approach was used to explore similarities and differences among German scholars’ responses. Cross-case data analysis was guided by factors (e.g., scholarly influences, time-management practices, research strategies) known to influence productivity among American scholars (e.g., Patterson-Hazley and Kiewra 2013). Finally, findings were validated using the member checking technique (Marshall and Rossman 2016; Merriam 2009). Each of the four scholars read the completed manuscript and made corrections and suggestions for improvement.

Results

In this section, findings from one-on-one interviews with the German scholars are reported. Findings begin with a glimpse of each scholar's background and research focus. The following sections report findings on trademark characteristics, scholarly influencers, time-management practices, research-management strategies, and advice for budding scholars. Similarities and differences between these German scholars and their American counterparts (e.g., Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013) are also identified throughout these sections.

A Glimpse of Who they Are

Table 4 provides a glimpse of the four scholars' present institutional affiliation, academic position, and research interests. From this table, it is evident that all four scholars are affiliated with major German universities, have earned (full) professor status, and conduct research in the area of learning. What is not shown are the shared experiences of these scholars at LMU where Mandl launched his own career and those of his three protégés: Gruber, Renkl, and Fischer. Here is that story.

After completing his doctoral work at LMU in 1975, Mandl secured a series of professorships at German universities. According to Mandl, these early opportunities helped him “become integrated into the scientific research community, learn the tricks and trades for designing projects and generating publications, and eventually become an expert in the field of learning and instruction.” Therefore, his publication rate at this time was “not as high as later on.” Finally, in 1990, Mandl returned to LMU as a professor. Securing a position at LMU dramatically increased Mandl's productivity. Mandl said, “When I got to Munich, I had a very stimulating environment, very engaged students, and enthusiastic colleagues that allowed me to publish at a high rate.”

Gruber and Renkl, in fact, were among the first habilitation scholars to join Mandl at LMU in 1991. Both joined Mandl's group at LMU after earning their doctoral degrees at the Max-Planck Institute for Psychological Research (MPI) under the guidance of Franz Weinert, a well-known cognitive developmentalist. Renkl described his time at the MPI as his first “productivity boost”—he learned the importance of publishing rigorous research in internationally-read journals, and he developed an international network of contacts. Renkl

Table 4 Background information

	Heinz Mandl	Alexander Renkl	Hans Gruber	Frank Fischer
Present institution	LMU	University of Freiburg	University of Regensburg	LMU
Present position	Professor of Education and Educational Psychology	Professor of Developmental and Educational Psychology	Chair of Learning and Instruction Professor of Educational Science	Professor of Psychology and Educational Sciences
Primary research areas	Learning and cognition, knowledge psychology, net-based learning	Worked examples, reflective writing	Professional learning, expertise	Technology-enhanced learning, collaborative learning

described the time in Mandl's group as a second "productivity boost"—a time when both Renkl and Gruber experienced a sharp upward trajectory in their methodological expertise and publication rates. When Renkl and Gruber began working under Mandl, the partnership benefits were both immediate and sustained. From their origination through the early 2000s, after Renkl and Gruber had left Mandl's group, the trio authored 143 collaborative works. Similarly, Fischer's arrival to the group in 1995 provided Mandl with another motivated collaborator. Since then, Mandl and Fischer have coauthored 70 publications.

Mandl's research group was in the midst of a series of studies aimed at improving the quality of teaching and learning processes in German vocational schools when Renkl and Gruber arrived. Gruber was the first to arrive at LMU. Gruber had, at the time, already developed an interest in studying expert performance and, according to Mandl, was able to align his expert performance interests to the improvement of learning processes in vocational schools. By integrating Gruber and his strengths into vocational education, Mandl provided Gruber with opportunities to both contribute to the group's productivity and to further his own expert performance interests. Today, Gruber's research continues to examine expert performance in multiple domains including art, chess, and common workplaces. For example, to understand how expert sculptors develop expertise, Gruber used eye-tracking technology to uncover how more skilled sculptors analyze the quality of art pieces compared with less-skilled sculptors and normal museum visitors (Gruber et al. 2016). In chess, Gruber explored how expert chess players outperform novice players on a chessboard reconstruction task (Schneider et al. 1993). In the workplace, Gruber's research showed that workplace expertise stems from two main situations: changes in daily tasks (i.e., novel versus mundane tasks) and learning from errors (Bauer and Gruber 2007).

Renkl arrived shortly after Gruber and joined Mandl and Gruber's ongoing projects. Additionally, Mandl sought opportunities to involve Renkl in research more aligned to Renkl's personal interests in learning and instruction. Thus, Mandl also involved Renkl in projects related to knowledge construction and inert knowledge. Renkl's interest in example-based learning also enriched some of the group's research projects. Today, one of Renkl's main research topics is how students learn from worked examples. Learning from worked examples means that students study problems with the worked solution steps provided to them. Then, they are asked to solve similar problems for themselves. Renkl's research confirms that learning from worked examples (a) enhances academic outcomes (Hilbert and Renkl 2009), (b) decreases the time needed to learn material compared with other methods (Salden et al. 2010), and (c) reveals common mistakes that foil problem solution (Große and Renkl 2007). From this research, Renkl developed his *Integrative Theory of Example-Based Learning* (Renkl 2014). This theory outlines (a) four phases of skill acquisition, (b) benefits of learning from worked examples, (c) the rationale for these benefits, and (d) principles for designing effective worked examples.

Fischer joined Mandl's research group as a doctoral student in 1995, 4 years after Gruber and Renkl arrived. Fischer had just completed his Master's thesis at Rheinisch-Westfälische Technische Hochschule (RWTH) Aachen University on how learners experience visual fatigue while reading from screens. Upon Fischer's arrival, Mandl incorporated Fischer, with his knowledge of perception and technology, into studies that evaluated how well radiologists processed information on highly resolved X-ray pictures. Fischer's main line of research today aligns with those early collaborations with Mandl. Fischer's present research explores how technology can be leveraged as a tool for learning. In particular, Fischer has studied how (a) providing social scripts enhance student learning in collaborative computer-supported learning

environments (Weinberger et al. 2005), (b) external information representations help students collaborate in computer-supported environments (Fischer and Mandl 2005), and (c) students engage in help-seeking behavior in computer-based learning environments (Aleven et al. 2003). From these and other investigations, Fischer and his colleagues developed the *Script Theory of Guidance in Computer-Supported Collaborative Learning* (Fischer et al. 2013).

Although Mandl's research pursuits during the 1990s and early 2000s were largely defined by his collaborations with Renkl, Gruber, and Fischer, he has also developed and maintained other research interests. Throughout his career, Mandl's primary research areas have shifted across learning and cognition topics and have been fueled by special priority programs (SPPs) he initiated. SPPs are research initiatives initiated by the German Science Foundation involving small groups of researchers who independently conduct related studies on a single topic. Throughout his career, Mandl has initiated three SPPs with colleagues. The first program ran from 1985 until 1992 and involved 20 individual projects (e.g., Lesgold and Mandl 1988; Mandl and Spada 1988) that explored knowledge psychology. In particular, this program investigated knowledge acquisition, modification, and application, especially with regard to computer simulations. The second program ran from 1992 until 2000 and involved 18 projects (e.g., Renkl et al. 1998). This program's purpose was to develop teaching and learning models to enhance basic business training. The third program ran from 2000 until 2006 and involved 16 projects (e.g., Fischer et al. 2007) that were intended to improve Internet-based knowledge communication in groups by applying established concepts from cognitive science, social psychology, education, and computer science. Initiating these three SPPs allowed Mandl to jumpstart personally relevant research initiatives and stimulate corresponding research throughout Germany.

In summary, it is evident that Mandl's research group at LMU was the center of excellence that drew Gruber, Renkl, and Fischer. For Gruber and Renkl, their experiences in Mandl's group built upon the knowledge and skills they had acquired during their doctoral work at the MPI under the tutelage of Franz Weinert. Once they arrived at LMU, Mandl masterfully integrated his three protégés into his research group in ways that fostered group productivity while also developing each scholar's personal research agenda. Meanwhile, Mandl vitalized the larger German research environment for several decades as well by initiating SPPs in interdisciplinary fields.

Trademark Characteristics

Previous studies showed that highly productive American scholars had trademark characteristics that shaped their research approach and aided research productivity. Similar to their American counterparts, each German scholar exhibited a trademark characteristic. Mandl is the "stalwart scholar," continuing his scientific investigations well beyond his official retirement. Renkl is the "straddler," balancing his research agenda across multiple domains. Gruber is the "expertise expert," using his findings on expert performance to enhance his own research. And, Fischer is the "director," deftly directing graduate students through the research and publication processes.

Mandl: Stalwart Scholar Mandl's career has spanned more than half a century. It began in a rural one-room schoolhouse in 1961, teaching grades 1 through 8, and continues today, 55 years later, as professor emeritus at LMU. A self-identified "workaholic," Mandl still logs 7-h workdays, travels to international conferences, and publishes in top-tier journals although

he has been officially retired since 2006. Mandl shows no desire to slow down. When asked what contributes to his longevity, Mandl said, “The outcome of projects is motivating. Successful projects stimulate me and I think that helps keep me young and fresh.” This unwavering motivation has helped Mandl continue to publish a high volume of research and remain active in the field. In fact, since 2006, Mandl has published more than 20 research articles and he regularly attends 10 or more research conferences a year. Mandl’s large publication output is, in part, a function of his longevity, spurred by his stalwart passion to investigate.

Renkl: Straddler Renkl has been recognized as one of the world’s most productive educational psychologists (Greenbaum et al. 2016; Jones et al. 2010), an honor attributable to his ability to develop studies that straddle multiple domains. Although Renkl identified example-based learning, reflective writing, and teacher education as his three main research areas, his research often straddles other domains such as journal writing, learning strategies, cognitive load, and more. Renkl said:

It makes it difficult for me to say what my main research areas are because we are touching on so many different things, and our papers are cited in many different areas. So, there are three main areas, but we really do a lot of different things.

Although researching multiple domains might seem scattered or unfocused, such is not the case for Renkl who has developed a strategy for straddling research domains. Renkl’s strategy is to use his most familiar research areas (such as worked examples) to explore new ones (such as educational journaling) by combining old and new domains. In one such study (Hübner et al. 2010), Renkl and associates split secondary students into two groups after they viewed a lecture—those who did or did not receive a worked example of a learning journal before writing their own journal entries. Results showed that participants who received the completed examples used more elaboration strategies (i.e., generated more novel examples of the material) in their learning journals than did students who did not receive worked examples. In another study straddling two areas, Berthold and Renkl (2009) demonstrated how the combination of self-explaining worked examples and multiple representations bolstered students’ learning of probability equations. In these and other cases, Renkl used knowledge from a highly familiar area, such as worked examples, to explore a new area. This domain straddling strategy permits Renkl to investigate multiple things in familiar ways and bolster his publication output.

Gruber: Expertise Expert Gruber applies information culled from his investigations of expert performance to his own research methods. While investigating the memory capacity of expert chess players, for example, Gruber noticed how expert-level chess players often sat together after their matches to analyze their decisions and learn from their mistakes. Gruber applied this expert routine to his research process. Although many scholars consider publication as the end of a study, Gruber, like the expert chess players, goes through a period of analysis and reflection throughout and following the publication process. According to Gruber, researchers should analyze why a given study succeeded or failed, what could improve in the future, and how expectations for a study met reality. Gruber explained how observing the post-match routines of expert chess players taught him the value of reflection. Gruber said:

After the match, even at the world class level, these two opponents still continue to sit at the board, analyze the game, and try to share their understanding of what they wanted to do, what they expected from each other, and where the expectations went wrong. That's where both of them learn a lot.

Gruber also acquired and applied the learning from errors strategy as a result of investigating workplace expertise. Gruber and colleagues (Harteis et al. 2008) found that employees who embrace and learn from errors have higher productivity and healthier work environments than those who shun mistakes. Gruber applies this expert lesson to his research approach by regularly reflecting on his research process to identify any missteps and by discussing identified problems with his collaborators. Finally, Gruber learned the importance of setting weekly goals as a byproduct of his research on elite marathon runners (e.g., Gruber 2013) and his own running expertise. Gruber said, "In sports, I learned that having a weekly training plan is something very helpful if you put a lot into it and are committed to what you do." Gruber applies goal setting to his own research by scheduling weekly meetings with his students, setting weekly goals, and relying on student collaborators to hold him and one another accountable for reaching those goals. Taken altogether, Gruber leverages the lessons learned from his studies on expert performers to enhance his own research strategies and productivity.

Fischer: Director Fischer is the director because he divides responsibility for the output of his research group among his students while serving as a watchful guide. Fischer said, "My student collaborators are really doing the research in terms of data collection, data analysis, and typically writing the draft of the paper." Meanwhile, Fischer positions himself behind-the-scenes—monitoring the progress of manuscripts, providing feedback, and helping maintain accountability within the group. To maintain productivity and to help assimilate his students into the group, Fischer and his student collaborators hold weekly meetings to discuss the status of ongoing projects. Fischer's primary role at these meetings is to provide students with feedback. Fischer said, "I try to encourage them to submit things to me very early in the draft stage and I give feedback. I really try not to be too destructive, but to identify the aspects that can be further developed." It is not uncommon for Fischer to provide his students with up to 15 rounds of feedback.

In addition, Fischer schedules regular one-on-one meetings with his graduate students, especially early in their academic careers. As his students progress through the program, Fischer creates a system where they become more autonomous, and the one-on-one meetings become less frequent. Fischer said, "lowering the frequency of these individual meetings depends on how well I think students are adjusting to the group and our ongoing research projects." By providing students with constructive feedback, acclimating them to his research group, and allowing them to take responsibility for ongoing projects, Fischer positions himself as a director, a watchful mentor whose primary responsibilities are to provide students with guidance and direction. Fischer's productivity, then, is largely the result of his ability to manage the work of graduate student collaborators.

In addition to directing the activities of his graduate student and post-doctoral collaborators, Fischer has been instrumental in bringing together researchers at the Munich Center for Learning Sciences. Fischer's efforts at the Center for Learning Sciences have amassed over \$7 million euros in research funding and brought together interdisciplinary researchers from eight different universities and research centers to conduct research in the learning sciences.

In summary, these trademark characteristics illustrate that scholarly productivity can be achieved using varying approaches. Mandl relies on decades of hard work and perseverance. Renkl uses familiar research variables to explore new domains. Gruber applies the lessons learned from his expertise research to become a more expert scholar. Finally, Fischer positions himself as a director, serving as a watchful guide as his students drive the research process.

Scholarly Influencers

In previous research, American scholars reported that notable advisors or colleagues ignited their productive careers. The German scholars in the present study also attributed their scholarly productivity to scholarly influencers. Mandl, for example, identified Hans Schiefele as his primary and, coincidentally, recurring influencer. Mandl first encountered Schiefele while pursuing his teaching diploma at LMU and observing Schiefele's class. Mandl was so enamored by the progressive teaching methods (e.g., group work, formative and summative assessment) Schiefele used that Mandl emulated these methods as a teacher himself.

Mandl's continued passion for Schiefele's methods prompted Mandl to return to LMU for graduate training after a few years of classroom teaching. Mandl was surprised to discover that his graduate school advisor was the same man whose teaching methods had impressed him as an undergraduate: Hans Schiefele. Now a professor, Schiefele offered Mandl a position as a research assistant in his Institute for Learning and Instruction. Working in this position, under Schiefele's supervision, led Mandl to first consider becoming a professor. Mandl said, "I never thought I would become a professor. But, when you are in this kind of environment you become socialized." Mandl also credits Schiefele for helping him develop a professional network by taking him to research conferences and introducing him to prominent scholars.

Schiefele's influence taught Mandl the importance of an influential mentor providing guidance early in one's career and prompted Mandl to make mentorship a priority as he worked with Renkl, Gruber, and Fischer at LMU. As previously mentioned, Mandl integrated these protégés into his research group by involving them in projects aligned with their already established strengths and interests. At conferences, Mandl helped them build professional networks. Regarding network building, Gruber said, "Of course we didn't know it at the time, but, in hindsight, it's really something that we took a lot of profit out of." Two early contacts that Mandl helped Gruber develop were with Herbert Simon and Anders Ericsson, two prominent scholars in Gruber's field of talent and expertise. Gruber said that Simon and Ericsson shaped his research interests by sharing their knowledge and experiences with him, a valuable opportunity made possible by Mandl's scholarly influence.

Beyond providing research and networking opportunities, Mandl continued to help his protégés develop an output-oriented mindset, where research productivity is stressed. Renkl said:

I grew up in a very rich academic environment where it was clear that you had to be productive... I think it's important for young students to go to a productive group because I think you adapt to what others do. If you're in the Mandl group or at the Max-Planck Institute and all of the others are publishing, then you want to do the same. If you're in a group with people who are only publishing once a year, then you do the same thing.

Learning to adopt this output-oriented mindset, which is common in the American "publish or perish" culture (Smith 1990), contrasts with Germany's long-standing publication tradition.

According to Gruber, many German colleagues spend countless hours writing 1000 page books related to the philosophy of education and learning rather than conducting scientific research. In Germany, conducting studies and writing research articles are seen as foreign traditions. Although Renkl and Gruber developed a taste for publishing internationally during their time at the MPI, Gruber noted how the first important lesson Mandl taught him was the importance of publishing scholarly research in internationally-read journals. By emphasizing this valuable lesson, Mandl positioned Gruber and others to resist German scholarship practices and, instead, adopt more American oriented practices of publishing scientific studies frequently. According to Fischer, Mandl also stressed the importance of writing quality. Fischer said:

What I learned from Heinz and pass along to my students is the importance of writing quality. It is important to write in understandable ways so the text can be understood as easily as possible by others. Heinz would ask us, “Are you more concerned with sounding intelligent or being understood by your audience?”

Because of the German habilitation system mentioned earlier, Renkl and Gruber were essentially doubly influenced—first during their doctoral program by advisor Franz Weinert at the MPI and then by Mandl during their habilitation work at LMU. Renkl, for example, wrote several peer-reviewed journal articles and developed an extensive professional network (e.g., Michael Pressley, Bob Siegler, and Dave Bjorklund) during his time at the MPI. Both Renkl and Gruber contend that it was the one-two influence of Weinert and Mandl that paved the way for becoming productive scholars.

In summary, Patricia Alexander's belief that productive American scholars are influenced by successful mentors and guides (Patterson-Hazley and Kiewra 2013) also held true for German scholars in the present study. Hans Schiefele influenced Mandl who, in turn, influenced, Gruber, Renkl, and Fischer in much the same ways and with similar success.

Time-Management Practices

American scholars in previous studies (Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013) maximized time and scholarly productivity by working long hours, applying time-management practices, and making sacrifices. So too do the productive German scholars in the present study. First, they work long hours. Fischer typically arrives at the office at 8:00 a.m. and works there until 8:00 p.m. Renkl too regularly works 8–10 h/day, and Gruber routinely works 70 h/week. Working long hours is a habit Renkl, Gruber, and Fischer acquired from Mandl while working in his research group in the early to mid-1990s. Prior to his official retirement in 2006, Mandl commonly worked 50+ h each week. Gruber described Mandl's work ethic and influence: “Heinz would arrive at the office sometime between 5:00 and 7:00 a.m.... Heinz was certainly a workaholic. He never asked us to be similar, but we certainly learned that from him.”

Second, the German scholars, much like the American scholars (Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013), structure daily routines to maximize research productivity. Mandl, Renkl, and Fischer all begin the work day early and spend several hours each morning on research tasks while at their mental peaks. Afternoons are filled with less demanding tasks such as advising, teaching, administrative responsibilities, and more scholarly work when time permits. Renkl, for example, usually uses early morning hours to write undisturbed at home and later uses down moments throughout the day to write or revise manuscripts and to provide feedback to graduate student collaborators. Similarly, Fischer, who

serves as department chair, occasionally asks his administrative assistant to hold calls and tell visitors he is unavailable when he turns his attention to scholarly activities. In addition, Fischer often works on manuscripts during evening hours and on weekends in a small, quiet room on the top floor of his house. By maintaining an orderly schedule and working long hours, these scholars control time and maximize productivity.

Gruber takes a less structured, more flexible approach to his daily routine than do his colleagues. Gruber arrives at his office sometime between 6:00 and 11:00 a.m. and leaves between 7:00 p.m. and 1:00 a.m. Gruber attributes this flexibility to never having been married or having children. Gruber said:

If I had a family or kids, it would be much more difficult to live my irregular days. The average day is highly irregular. Starting at 6:00 in the morning or working through the night, that's not easy if you have a family and some fixed schedule.

Gruber's irregular days, though, are not without goals and plans. Gruber's experience as a runner taught him the value of recording goals and daily plans. He brings that lesson into his work life. Gruber said, "I learned from my running schedule and training plans, there are duties you have to complete. I write these down very clearly each day along with plans for accomplishing them."

Because Gruber's workdays stretch from morning until night, he intermixes academic and leisure activities. An avid runner, Gruber typically leaves the office for a few hours during the afternoon to jog, before returning for several more hours of work. Gruber explained his irregular routine by saying, "My colleagues often say, 'It's so early in the afternoon, you can't leave already.' But, they leave at six in the evening and I continue on until one in the morning." Although Gruber's time routine seems less stable than his colleagues', Gruber credits his changing schedule for his high motivation and energy to sustain 70+-h workweeks.

Heavy workloads also require some sacrifices for the German scholars, usually involving family and social activities. Although Mandl and his wife regularly tried to visit the theater and restaurants, Mandl admits it was difficult to maintain an active social life in the midst of his heavy workload. Fischer agreed, saying:

What I sacrifice are the evening hours, the evening hours that many people spend with their families or friends... When my children were younger, all of them were asleep when I came home. I thought of that as a sacrifice always.

Fischer estimates that his wife, meanwhile, spends approximately 95 % of her time caring for the home and children. For Renkl, his workload has also caused him to commit less time to helping out around the house. During high-pressure work times, Renkl estimates he is only able to do 10 % of the household chores, leaving the rest to his wife.

Being productive requires an intensive time commitment and personal sacrifice for German and American scholars alike, but the German and American systems differ in time allocation in two distinct ways. One way benefits the German scholars—their sabbatical system, and one way hinders them—their administrative responsibilities. On the plus side, the German sabbatical system provides more time for scholarly activities than does the American system. Although professors in the USA are typically granted sabbatical every 6 or 7 years, German professors receive a 6-month sabbatical every fourth year. According to Fischer, receiving frequent sabbaticals helps offset the amount of time otherwise dedicated to teaching and administration. These frequent sabbaticals serve as an optimal time for output-oriented German faculty to focus on their research programs.

On the downside, the German system requires professors to rotate through burdensome administrative positions such as college dean or department chair that usually require two-year commitments. At the time of our interviews, Gruber and Fischer (both former deans) were department chairs while Renkl was preparing to assume the college deanship at his institution. All the German scholars admitted that research activities and productivity diminish while fulfilling administrative duties. Renkl said, "I think productivity will go down, but won't stop completely because of how much I collaborate with others. But, I won't be able to provide as much feedback and will need to be more cautious about beginning new collaborations." Although American scholars are not compelled to serve as administrators, most of those investigated by Kiewra and colleagues (Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013) did serve as administrators at some point. Dale Schunk had the heaviest administrative load serving as department chair for 8 years and as college dean for 9 years.

In conclusion, these German scholars exhibit time-management practices similar to those reported by American scholars (Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013). First, the four German scholars work many hours a week. Although Mandl has slowed down since his retirement in 2006, he still works approximately 40 h each week, while each of his protégés logs 50–70 h. Second, three of the scholars (Mandl, Renkl, and Fischer) manage time in structured ways that capitalize on using morning hours for scholarly activities when energy levels are highest. Gruber, meanwhile, maintains a more variable schedule where he intermixes his leisure and professional activities. In this way, Gruber is more like American scholar Patricia Alexander (Patterson-Hazley and Kiewra 2013) who reported that she did not restrict scholarship activities to the morning hours and proclaimed, "I can write anywhere, anytime. I can write on the fly. I write whenever I have time to write." Last, heavy workloads come with a price, usually the sacrifice of spending time with family and friends. Two factors, though, differentially affect American and German scholars in terms of time availability. Compared with American scholars, German scholars have more time to spend on scholarship because of more frequent sabbaticals but less time to spend on scholarship because of occasional but compulsory administrative duties.

Research-Management Strategies

Previous studies (Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013) showed that American scholars used several strategies to enhance research productivity and manuscript quality. For example, they held weekly meetings with graduate student research teams, worked on several different research projects simultaneously, revised manuscripts dozens of times before submitting them to journals, and welcomed critical feedback from journal reviewers to improve manuscripts further. The German scholars investigated in the present study use research-management strategies similar to their American colleagues. Specifically, Mandl and his former students (a) meet weekly with collaborators, (b) maintain multiple ongoing studies, (c) frequently revise manuscripts before submitting them to research journals, and (d) embrace feedback from reviewers and colleagues. In addition, these German research groups include post-doctoral researchers. Post-doctoral researchers were not included in the research groups of prominent American educational researchers studied by Kiewra and colleagues (Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013).

German research groups typically consist of the Ph.D.-level faculty member, one or two post-doctoral researchers, and graduate students. The German scholars believed this structure has advantages over that of American research groups that did not include post-doctoral researchers (Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013). First, post-doctoral researchers boost the productivity of the research group by initiating and leading investigations in their area(s) of expertise. Renkl, for example, noted how his own research agenda continues to be influenced by the interests of post-doctoral researchers in his group. Second, post-doctoral researchers often act as the daily supervisors and feedback agents for graduate students—thereby freeing up more time for the faculty advisor. According to Renkl, the prominent role of post-doctoral researchers contributes substantially to the productivity of German research groups and the faculty advisor.

Regarding research team meetings, Mandl held weekly research meetings with his collaborators back when Gruber and Renkl were among his students at LMU. Then and now, Mandl and his team of graduate students and post-doctoral researchers meet every Tuesday from 9:00 a.m. until noon to present their accomplishments from the previous week and to discuss new goals. Reflecting back on these meetings when Gruber and Renkl were in his research group, Mandl said:

That was where some of the strongest discussions took place, because I was very hard but also very helpful. Alexander, Hans, and the others had to speak about what they were working on and how they were going to conduct experiments.

Today, Gruber, Renkl, and Fischer hold similar meetings with their students and post-doctoral researchers. Gruber and his team, for example, hold weekly “whiteboard meetings” at which Gruber provides feedback to his team about their research and writing progress. Gruber described these meetings:

I have a whiteboard in my office. The students write their plans on the whiteboard and then I go up and wipe out everything that is not clear, which often ends up being the complete board by the end of the meeting. That sounds very destructive, but it is really constructive because it tells them to make things clear.

Similarly, Fischer and his students hold weekly “white box” meetings—named after the pizza boxes that end up scattered around the room as the group eats pizza and discusses ongoing projects and goals. Additionally, Fischer holds regular one-on-one meetings with each student to help keep team members productive and accountable. Maintaining accountability is also important to Renkl, who said:

You don't want to be the only one who says that you only reached 30 % of your writing goal for that week while the others are at 100 %. When this happens, students have discussions about why they didn't reach their goals and get stern advice on how to reach their goals next time.

Holding regular meetings, setting weekly goals, delegating leadership responsibilities to post-doctoral researchers, and maintaining accountability within their research teams allows these German scholars to handle multiple ongoing research projects. Mandl and Gruber's groups typically work on 3 to 7 research projects at a time, Renkl and his students maintain approximately 10 studies, and Fischer's team juggles about 15 projects. A variety of strategies are used to manage such a large number of projects. Fischer uses his trademark “director” characteristic

of delegating responsibilities, monitoring progress, and providing feedback. Fischer, in particular, designates advanced graduate students or post-doctoral colleagues as project leaders on several projects in order to share and lighten his administrative responsibilities. Renkl and his group try to stagger the timing of their research projects so that they are at different stages of completion. Renkl described the present state of his group's output by saying: "We're working on two projects where we are writing the proposal. We have six to seven projects that are running and two more that we are trying to get accepted for publication." By staggering project timing, Renkl and his group always have a variety of tasks (e.g., study design, material development, data collection, and manuscript writing) to keep them busy.

Weekly student meetings and maintaining multiple ongoing research projects allows these German scholars to produce a large quantity of publishable manuscripts. However, the quality of these manuscripts is also important to these German scholars, all of whom emphasized crafting manuscripts that are easily read and interpreted by their intended audience. Two primary writing strategies were identified. First, manuscripts are revised numerous times before journal submission. Gruber noted that he learned the importance of manuscript revision while working in Mandl's group. Gruber said, "Mandl was known for going through papers 10 or 15 times and always looking for inconsistencies and weak points." Fischer agreed, noting that Mandl would sometimes review up to a dozen versions of Fischer's manuscripts before agreeing to submit them for publication. Now, Fischer uses a similar process with his graduate students. Fischer said, "I'm trying to guide my students toward effective writing. They compose a draft and I give them feedback. We have up to fifteen feedback rounds before we submit our papers." Second, the German scholars value the expert feedback they receive from reviewers. Renkl and his collaborators, for example, submitted a worked-example manuscript wherein the worked examples had only one solution method. Reviewers, though, pointed out that many problems have multiple solution methods. Renkl described how his research team responded to this criticism: "We agreed and began conducting studies of worked examples providing multiple solution methods. So, we reacted to this criticism positively and produced studies that are better and now heavily cited" (see Große and Renkl 2006). Instead of shunning critical feedback, Renkl and his colleagues embraced it and used it to improve their work. Renkl said, "Many unsuccessful people bash reviewers. They say that other people don't like their research because they are biased or don't fully understand what they are trying to say. Such reactions are not helpful."

In summary, the German scholars' research-management strategies mirror those used by highly productive American counterparts (Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013). Both groups of scholars hold weekly meetings with student collaborators, balance multiple studies, revise manuscripts frequently, and follow and embrace reviewer feedback. However, unlike American scholars studied previously (Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013), German scholars emphasized the important roles that post-doctoral researchers play in enhancing research group productivity.

There appears to be two other favorable aspects particular to the German research culture that aid productivity: research funding opportunities and ongoing advisor-student collaboration. Regarding research funding opportunities, Renkl believes that the German Research Foundation creates a favorable atmosphere for German scholars through their "normal procedure," which Renkl described:

You can submit a proposal at any time on any topic. Unlike the American system, you don't have to wait for a call or your idea doesn't have to fit to the topic of the call, you just submit it. It has to be a good proposal, but the chances of it getting accepted are maybe about 25 % to 40 %. I think this is an advantage for Germany.

Regarding advisor-student collaboration, in Germany, there is no stigma attached to graduating students continuing to conduct research with their advisor. Meanwhile, this practice is frowned upon in American universities where newly minted graduates are expected to cut ties with their advisor and cut their own research path. As previously mentioned, Mandl has a long-standing publication history with each of his three protégés that continued after they left his research group. Fischer, meanwhile, continues to publish with Mandl and frequently collaborates with his own former students. Fischer said:

My long-standing collaborations with some of my former Ph.D. students are very important for productivity. As I understand the American system, it is not a good idea to do your doctoral work with your supervisor and then to continue publishing with him a lot afterwards. This is exactly what happens in a lot of places in Germany.

Instead of forcing students and advisors to abruptly cut ties after graduation, the German system encourages ongoing and fruitful collaboration.

Advice for Aspiring Scholars

These German scholars' interview responses offer aspiring educational psychologists indirect career, time-management, and research-management advice that is summarized in Table 5. In addition, German scholars were asked to supply emerging scholars with direct advice for becoming highly productive. Seven recommendations emerged.

1. *Find a research group.* Mandl encouraged all graduate students to get involved in a research group, especially with more advanced students. Mandl said:

Join a research group and work with them. You might not be ready with all of your studying, but join a research group as early as possible so you can practice and learn. Normally, studying is very theoretical. Joining a research team can help you make sense of what you are studying.

2. *Be a self-starter who is open to advice.* Gruber advised students to be receptive to guidance but to not be afraid to take initiative. Gruber said:

There are some students who have very independent ideas and insist on their ideas. My experience tells me that, in most cases, that doesn't work well because they insist on being so independent that they don't ask for advice.

Instead of adopting an independent approach to research, Gruber said that students should be open to the advice and guidance of their advisors and colleagues. Gruber cautioned, however, against growing dependent on guidance. He said:

Some students are too dependent and ask for help every step. They always run to us and ask if it's okay to do this and that. I don't think that's something any of us ever did in Heinz Mandl's group.

Table 5 Indirect advice for aspiring scholars from the four German scholars

Career advice
Work at a university with supportive administrators
Recruit motivated graduate students
Carve a well-defined research agenda, but do not be afraid to explore new domains
Find a mentor who can help guide you early in your career
Be prepared to make sacrifices
Time-management advice
Work hard for many years
Be prepared to work long hours
Arrange your schedule around your natural body rhythm
Take advantage of time between scheduled tasks
Research-management advice
Collaborate frequently with students and colleagues
Maintain multiple ongoing studies
Revise frequently
Embrace feedback from reviewers and peers
Maintain accountability within your research group

Rather, Gruber advocates that students strike an appropriate balance between independence and help seeking.

3. *Familiarize yourself with the expertise literature.* If he could only offer one piece of advice, Fischer would tell aspiring educational psychologists to familiarize themselves with the expertise literature (e.g., deliberate practice, centers of excellence, etc.) and to then apply those ideas to one's career as an educational researcher.
4. *Establish a professional identity by attaching your name to a research domain.* Renkl encouraged aspiring scholars to focus research investigations on a specific topic such that one's name becomes attached to that topic. Renkl described the benefits of establishing a professional identity by saying, "What you should achieve is to have a topic connected to your name... I think it helps you get known and get cited... Don't run after the newest or most in vogue topic." Renkl's advice stems from his own international notoriety as the worked-example expert. His curriculum vita lists dozens of publications, conference presentations, and invited talks related to worked examples. By establishing himself as an expert in the design and use of worked examples, Renkl has forever attached his name to this research agenda.
5. *It is never too late; take the necessary steps to achieve a productive career.* Although Mandl and Renkl are internationally known researchers, neither seemed to have the right pedigree or early experiences that would foreshadow a productive scholarly career. Renkl said, "I'm from a non-academic family and my first eight years at school were not that terrific. Nobody would have thought of me as a future university professor." Similarly, Mandl said, "I didn't think I could become a professor. But, I went to LMU to complete my dissertation and thought that in some way something good could happen, but I never thought I would become a professor." To reach this point, Renkl said, "I never had the

self-conception that I could ever be productive or an internationally well-known researcher. I just took it step-by-step and somehow it evolved.” Steps taken by Renkl early in his career included joining Mandl’s research group while it was full of social and environmental supports, developing a system of professional contacts, adopting an output-oriented approach to research, and “straddling” research domains.

6. *Network, network, network.* With approximately 95 % of his colleagues residing outside of Germany’s borders, Gruber tells his students to network as much as possible, especially with international scholars. Gruber introduces his students to his professional network and encourages them to begin building contacts of their own while attending conferences. Gruber described the value of developing an extensive professional network by saying, “Those who are inspired to join different groups and develop contacts have an easier time moving forward with their own research.” Gruber said that having a system of knowledgeable and experienced contacts is especially helpful for graduate students and junior faculty who can turn to these contacts for guidance while conducting research.
7. *Conduct Champions League research.* Productivity for educational psychologists is often judged by the number of publications they have in leading journals. However, Renkl drew an analogy to the leading European soccer league (the Champions League) when describing his publication strategy. Renkl said:

You have to show that you can play in the Champions League. So, publish a few papers in top journals, but also publish in well respected journals with higher acceptance rates. You want to have a good balance between the number of papers that you publish while also showing that you can play Champions League.

Renkl said that balancing submissions between Champions League journals and less rigorous but well respected journals can help researchers both establish competence and notoriety while maintaining a steady research output stream.

Discussion

Our interviews with German scholars yielded considerable information about how they are able to be so productive. In the following sections, we (a) summarize our findings and connect them to previous research, (b) identify key differences between American and German systems, (c) identify study limitations and propose future directions for research, and (d) offer final conclusions.

Summary and Connections to Previous Research

The four German scholars share several similarities with American educational psychologists studied previously (Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013). Like their American counterparts, German scholars have (a) long and productive research careers, (b) trademark characteristics, (c) scholarly influencers, (d) efficient time-management practices, and (e) well practiced research-management strategies. These similarities are discussed below.

Long and Productive Research Careers Productive American and German scholars have lengthy careers. Collectively, scholars across both of Kiewra and associates' studies (Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013) had long careers with an average career length of 32 years, ranging from Michael Pressley's 20 years (Kiewra and Creswell 2000) to Barry Zimmerman's 41 years (Patterson-Hazley and Kiewra 2013). Overall, these German scholars have had lengthy careers too, with an average career length of 25 years, ranging from Fischer's 15 years to Mandl's 41 years. Moreover, yearly production rates are similar and high for German and American scholars. Mandl produces approximately 12 total publications every year, followed by Renkl (10), Gruber (10), and Fischer (9). These average yearly output rates are similar to those of American scholars Richard Mayer (8), Patricia Alexander (4), Barry Zimmerman (4), and Dale Schunk (3) as reported by Patterson-Hazley and Kiewra (2013). Overall, findings suggest that high productivity for both German and American educational psychologists is only possible by sustaining scholarly productivity across several decades.

Trademark Characteristics As was true of American scholars (Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013), all the German scholars have a defining characteristic. Mandl is the "stalwart scholar," whose high publication totals can be attributed to hard work and perseverance across several decades. Renkl is the "straddler," who uses his expertise in a familiar domain as an anchor to study new domains. Gruber is the "expertise expert," who applies the lessons gleaned from his talent development research to his scholarly routines. And, Fischer is the "director," who carefully directs his team of graduate student and post-doctoral collaborators. In fact, some German scholars share similar trademark qualities to American scholars. Like Fischer, Richard Anderson's productivity is largely attributed to his enculturation and leadership assignment of graduate students (Kiewra and Creswell 2000). Barry Zimmerman shares Gruber's strategy of using lessons learned from his research to better himself as a scholar (Patterson-Hazley and Kiewra 2013). And, Richard Mayer's "systemizer" trademark is akin to Renkl's "straddler" trademark as both emphasize programmatic research agendas that span multiple domains. Overall, the presence of these trademark characteristics highlights how productive scholars from both America and Germany often have a primary approach to scholarly inquiry.

Scholarly Influencers Productive American and German scholars are influenced by mentors. Renkl, Gruber, and Fischer all spoke about the opportunities Mandl provided them in his research group: detailed writing feedback, invitations to research conferences where Mandl helped them expand their professional networks, and involvement in ongoing projects. As reported previously, Gruber captured Mandl's influence when he said, "Heinz was certainly a workaholic. He never asked us to be similar, but we certainly learned that from him." Essentially, Mandl provided the same opportunities to his students that Hans Schiefele provided to him while Mandl was a graduate student at LMU. American scholars also relied on and benefited from mentors. While Michael Pressley was a graduate student at the University of Minnesota, for example, he traveled to the University of Wisconsin to conduct research with Joel Levin on children's memory (Kiewra and Creswell 2000). Dale Schunk and Barry Zimmerman credit their scholarly growth to lessons learned from Albert Bandura. Schunk said, "I was able to work closely with well-known people (like Albert Bandura)... I was their

research assistant and all of them made sure that I learned what I needed to learn. I give the professors there a lot of credit for that” (Patterson-Hazley and Kiewra 2013, p. 29). Productive educational psychologists from America and Germany seize opportunities to learn from highly productive scholars early in their careers and apply those lessons throughout their own productive careers.

Efficient Time-Management Practices Accumulating hundreds of publications is a time-consuming pursuit, and scholars from America and Germany use well-honed practices to maximize time. Most arrive to work early in the morning, work into the evening hours, and log 50+-h weeks. Richard Mayer (Patterson-Hazley and Kiewra 2013) and Frank Fischer, for example, both arrive to work around 8:30 a.m. and spend mornings when their energy is highest working on research. Patricia Alexander (Patterson-Hazley and Kiewra 2013) and Hans Gruber regularly work through much of the night while logging 70+-h workweeks. However, dedicating considerable time to work comes with sacrifices. Some of the American and German scholars identified diminished time with family and friends, giving up hobbies, and a lack of sleep as their biggest sacrifices.

Effective Research-Management Strategies In addition to practicing effective time management, American and German scholars also employ effective research-management strategies. First, productive scholars from both countries hold weekly meetings with their collaborators to report on the status of their multiple ongoing studies. Frank Fischer, Richard Anderson (Kiewra and Creswell 2000), and Richard Mayer (Patterson-Hazley and Kiewra 2013), for example, hold weekly group and individual meetings with research team members to answer questions and discuss ongoing studies. Second, researchers from both countries revise manuscripts multiple times before submitting them for publication. Michael Pressley said, “At one point I actually kept track and I was doing 40 revisions after the first draft... Now I would say there’s always two or three really monstrous revisions and then a ton of fine tuning” (Kiewra and Creswell 2000, p. 152). Similarly, Mandl is known for revising manuscripts 10 to 15 times to improve weaknesses and correct inaccuracies before submission. This habit is now shared by his protégés (Renkl, Gruber, and Fischer) who all revise manuscripts a dozen or more times before submitting them for publication. Third, productive American and German scholars embrace feedback from journal editors and reviewers. Instead of being close-minded to critical feedback, Renkl believes that productive scholars must embrace criticism and use it to enhance the quality of their research. Renkl said, “I always tell my graduate students to look at the core of the criticism. Maybe you weren’t clear enough. Don’t blame the reviewers.”

Key Differences Between American and German Systems

Several important differences in how American and German higher-education systems approach (a) educational training, (b) research group composition, (c) funding opportunities, (d) sabbaticals, (e) administrative responsibilities, (f) research traditions, and (g) advisor-advisee collaboration also emerged.

Educational Training The habilitation system used to prepare future scholars in Germany is more intensive than the process used to train American scholars. Although both American and German scholars complete doctoral training, German graduates must also complete a post-doctoral habilitation phase wherein they conduct high-quality research akin to a second dissertation before being eligible for professorships. All four German scholars spoke positively about habilitation and believed that it prepared them for a professorship and a productive career more than their doctoral work.

The habilitation system led to German scholars in the present study identifying two primary influencers: graduate school doctoral advisors and habilitation supervisors. Renkl and Gruber completed their doctoral work under advisor Franz Weinert at the prestigious Max-Planck-Institute for Psychological Research before arriving in Mandl's group at LMU for habilitation. Renkl described his time with Weinert as his first "productivity boost" where he learned the fundamentals of conducting research and building a professional network. Moving into Mandl's group for habilitation served as a second "productivity boost" that helped set Renkl and Gruber on the path to becoming highly productive scholars.

Research Group Composition Unlike the productive American scholars that Kiewra and colleagues investigated (Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013), these German scholars have faculty-led student research teams that also include post-doctoral researchers. These post-doctoral researchers are instrumental in bringing expertise to the group as well as overseeing the day-to-day activities of graduate student collaborators. Their contributions lead to greater productivity for all and especially the senior professor.

Funding Opportunities According to these German scholars, it is easier to secure research grants in Germany than in the USA. Renkl, for example, said that the German Science Foundation accepts proposals at any time on any topic. Moreover, Renkl estimated that his chances of getting a research proposal accepted are as high as 40 %, a much higher likelihood than American scholars have with the National Science Foundation, which has a 14 % acceptance rate (NSF 2015). Mandl's research experiences might best exemplify Germany's favorable funding opportunities. Mandl has spent the majority of his career initiating and working on Special Priority Programs—nationwide research initiatives that, if accepted by the German Science Foundation, provide long-term funding for teams of researchers to explore a shared topic.

Sabbaticals Professors in both Germany and the USA are offered periodic sabbaticals to provide them with extended time to work on scholarly projects. Sabbaticals, though, are offered more frequently in Germany (once every 4 years) than the USA (once every 6 or 7 years). More frequent sabbaticals give German scholars more opportunities than their American counterparts to advance research programs.

Administrative Responsibilities Surprisingly, highly productive scholars from America and Germany occasionally fulfill time-consuming administrative positions at their

respective universities. In addition to their teaching and research responsibilities, productive scholars from both countries have spent years serving as department chairs, college deans, and fulfilling other administrative roles. The difference is that professors in Germany must serve in these administrative capacities whereas administrative service is usually optional in the American higher-education system. This obligatory service makes it all the more necessary for German scholars to employ effective time- and research-management practices. Renkl, for example, stressed that deliberate research strategies, such as collaborating with students and colleagues, help alleviate some of the burden created by these administrative responsibilities.

Research Traditions German scholars indicated that their productivity hinged, in part, on going against a long-held German tradition of focusing one's scholarship efforts on writing long books about philosophical issues of education. Instead of adhering to this long-standing tradition, Mandl taught his protégés to craft frequent empirical research studies and disseminate findings in scholarly journals—an approach more aligned with American traditions.

Advisor-Advisee Collaboration In the USA, junior faculty are encouraged to halt collaboration with their graduate advisor, seek new collaborators, and assume full responsibility for their research program. This is not the case in Germany where junior faculty continue to collaborate with their advisors. This ongoing collaboration allows new German scholars to pursue already familiar research avenues from their doctoral and habilitation experiences and to maintain fruitful collaborations.

Study Limitations and Future Research Directions

The present study investigated a cohort of productive German scholars. Although this is a good start in extending investigations of productive educational psychologists outside American borders, productive scholars reside in other international countries as well (Kwiek 2016), and future studies should cross those borders to explore more of the world's most productive scholars. Additionally, future studies should continue to explore how cultural differences influence research productivity. For example, publication totals suggest that these German scholars place more emphasis on publishing books and book chapters than their American counterparts (e.g., Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013). Future studies might continue to explore how differences in research traditions influence productivity.

Future research might also address the present study's chief limitation: using a convenience sampling procedure to recruit participants. One of the present study's investigators had established connections with some of these German scholars in advance of the study and chose to investigate them because of their high productivity and shared connections. Although this approach produced the first examination of a scholarly cohort, future research might select highly productive participants or cohorts based on a more objective process as was done in previous research (e.g., Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013) where nomination-based selection procedures were used.

Conclusions

The present study adds to the field of educational psychology's understanding of our most productive members by moving beyond American borders and exploring factors that influence productivity among a cohort of German scholars all tied to Ludwig-Maximilian University Munich. Findings showed that this collection of German scholars share many similarities with their American counterparts studied previously (Kiewra and Creswell 2000; Patterson-Hazley and Kiewra 2013), but also benefit from several differences that exist in the German higher-education environment (e.g., habilitation, research funding, sabbaticals, and ongoing advisor-advisee collaboration). We hope that other educational researchers will follow our lead and investigate productive scholars—both as cohorts and as independent scholars—beyond American borders.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

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