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# How to Promote and Measure Reflective Skills in Depth and Breadth of English and Physics Teacher Trainees

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**ABSTRACT**   Supporting reflection in preservice during university-based training is, without doubt, a crucial aspect in attaining teacher professionalism. Therefore, an on-campus seminar designed to relate theory to practice and vice versa – the so-called 'Lehr-Lern-Labor-Seminar (LLLS)' – was implemented over the course of five terms to stimulate reflective skills of English and Physics teacher trainees. Investigations on the effectiveness of three types of the LLLS (no video and two types of video-supported reflections) compared to a parallel group (PG) and a control group (CG) occurred in a mixed methods quasi-experimental study. Reflective skills were elicited with vignettes, relevant covariates with questionnaires. Reflective development was then traced in the dimensions depth and breadth employing a qualitative content analysis. MANCOVA (Multivariate Analysis of Covariance) and regression analyses revealed a substantive increase of reflective depth for English and Physics teacher trainees and breadth development for English LLLS-participants in contrast to both, a PG and a CG, even when controlling for the subjects' individual prerequisites.

**KEYWORDS**   reflective skills, mixed methods, reflective depth, reflective breadth, English and Physics teacher trainees

## 1    RESEARCH MOTIVATION AND TREATMENT DESCRIPTION

This study aimed to investigate the characteristics of a professional English or Physics teacher, specifically the ability to reflect on one's actions as an expert in teaching and learning (Schön, 1987; Körkkö et al., 2011). We found that there

is currently a lack of reliable data on how to promote reflective competence in teacher trainees. To address this, we developed a "Lehr-Lern-Labor-Seminar (LLLS)", one for English and one for Physics teacher trainees at Freie Universität Berlin. The LLLS is a 12-week long university class with each class being 90 minutes long. It combines theoretical and practical phases, and includes micro-interventions (in detail Klempin, 2019) to promote reflective competence, such as a Cognitive Apprenticeship (Rodgers, 2002; Schädlich, 2015), Noticing Training (van Es & Sherin, 2002), and live micro teaching sessions with school students, reducing the complexity of teaching requirements (Jerusalem & Schwarzer, 2002; Helsper, 2016). The LLLS also includes structured reflection sessions (Rodgers, 2002). These measures are incorporated into all seven steps of the LLLS cycle (Rehfeldt et al., 2018), providing ample opportunity for student reflection and promoting the development of reflective competence among teacher trainees.

## 2     RESEARCH HYPOTHESES AND RESEARCH BACKGROUND

In order to determine the effectiveness of the LLLS and its' micro-interventions, it was compared with a LLLS without micro-interventions (parallel group/PG) and with a classical theory-oriented class without an opportunity to plan, act out, and reflect on teaching practice (control group/CG). The LLLS (experimental group/EG) was divided into three sub-groups: One in which reflection took place without video support, one in which students' own teaching was recorded and reflected on, and one group in which trainees used their fellow students' teaching for reflection. Reflective competence was defined in two dimensions, depth[1] and breadth[2] (Leonhard et al., 2011), and we investigated whether there is a stronger increase in both for the LLLS variants in comparison to the other groups. Reflective competence was also assessed as a superordinate construct, as previous studies on reflective competence in foreign language didactics have examined primarily reflective depth, hence, covering the construct only by 50 % (Schädlich,

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[1]  Depth of reflection can be paraphrased as *the way students reflect* (Abels, 2011). In terms of depth of reflection, research on expert teachers has shown that novices largely reflect descriptively on teaching situations.

[2]  Breadth relates to the *what students reflect on* (König et al., 2015). Expert teachers tend to hypothesize and look for causes. Experts also have a greater tendency to generate alternative courses for future action. Looking for causes and alternative avenues for action, experts are more likely to draw on theoretical knowledge in their reflections. Here, depth and breadth intersect, as reflective breadth describes the kind of didactic knowledge and intensity teachers draw on for their reflections, and with what intensity.

2015; Roters, 2011). This study is the first to promote and measure reflective competence in this way.

## 3     RESEARCH DESIGN, METHODS, AND INSTRUMENTS

The effectiveness of the LLLS was tested within the framework of a mixed methods approach (Kuckartz, 2014). The research goal was to ultimately be able to make generalizable statements (Mayring, 2011). For English, data were collected in all three LLLS variants, in the CG and PG (study 1). For Physics, data were only gained in one LLLS, not in various sub-groups (study 2). Data were collected at two points of measurement; *pre,* at the beginning, and *post,* at the end of class. Didactic reflection skills were gauged qualitatively with open written discourse vignettes (Rehm & Bölsterli, 2014). Covariables were collected quantitatively employing questionnaires and comprised student teachers' gender, age, semester, propensity to write (character count in vignettes), their tendency towards social desirability (Stoiber, 1999), personality traits for successful reflection (Satow, 2012; Dewey, 1933), perceived class instruction quality, and prior practical experiences and reflection knowledge (in detail Klempin, 2019).

## 4     ANALYSES: QUALITATIVE & QUANTITATIVE

For data analysis, qualitative data were first subjected to a qualitative content analysis (QCA; Kuckartz, 2014) resulting in different levels of reflection skills. Then a MANCOVA was conducted with those levels. Without referring to a theory model, first, an inductive QCA was conducted to determine depth of reflection. In a second step, a theory model was used for a deductive QCA in which vignettes were allocated to four levels of reflective skills (Abels, 2011). To guarantee quality of the ratings for depth of reflection, Krippendorff's alpha was calculated as a measure of agreement indicating a very good fit between raters ($\alpha =$ .92***, 2004, p. 241; Snodgrass, 2006). Breadth of reflection relied on a deductive QCA, as König et al.'s (2015) empirical model of pedagogical content knowledge (PCK) was referenced here. The final theory model for this study distinguishes four dimensions of subject didactic knowledge: 1. curricular knowledge, 2. learner knowledge, 3. strategy knowledge and 4. Teaching English as a Foreign Language (TEFL) knowledge. The quality of the category formation for breadth of reflection was ensured though a process of communicative consensus, wherein mismatches and doubtful cases in ratings were negotiated by the coders after

each analysis loop. In addition, PCK maps (Park & Chen, 2012) were used to visualize the extent to which PCK was addressed in its four dimensions (Klempin, 2019). For English and Physics two separate analyses to answer the above-mentioned research hypotheses were conducted. Study 1 addressed reflective depth and breadth for English with a MANCOVA with repeated measures. Post-hoc t-tests were calculated. Study 2 focused solely on reflective depth, but for both subjects. Multiple linear regression analyses and post-hoc t-tests were conducted.

## 5     RESULTS AND DISCUSSION

**Study 1:** When contrasting all LLLSE-interventions with CG and PG, significant and medium effects for depth and breadth, in favor of the LLLSE-interventions (ds > .67), were detected. Between the three LLLSE-interventions (1. reflections with no video, 2. with video, 3. with a fellow trainees' video) no significant differences were detected ($p_s$depth > .051, $p_s$breadth > .56, $p$ = .47). For reflective breadth, increase differences were statistically significant compared to PG and CG for the dimension strategy knowledge in all LLLSE-formats. The TEFL dimension developed significantly more exclusively in the regular LLLSE (no video-based reflections), again, compared to PG and CG. The learner dimension yielded significant increases only for the LLLSE with reflections based on fellow students' videos, effect sizes ranging from medium to high. For the curriculum knowledge dimension, no differences were detected across all groups.

**Study 2:** Analyses on aggregated data for English and Physics LLLS-participants yielded insignificant differences in the increase of depth per subject (t-test, $p$ > .73). Further, no differences were detected between, both, the PG and the CG ($p$ = .76). Significant differences with medium to high effects could, however, be ascertained for all LLLS formats as compared to, both, the PG and the CG. Especially the differences in means for the increase in reflective depth between the LLLS and the CGs, as well as the PG gained statistical significance ($p_s$ < .02), mostly even with high effects. Moreover, all covariates were shown to be statistically insignificant ($p_s$ = .05). Eventually, a medium empirical correlation between reflective depth and breadth was found ($r$ = .51***).

To sum up, didactic reflective competence was not only effectively promoted among EFL and Physics teacher trainees, but also successfully recorded and measured for the first time. Reflective competence of EFL student teachers was not only strengthened in depth, but also in breadth. After attending the LLLSE, participants reflect statistically significant more in a productive, multi-perspective,

more theory-based and coherent manner. These student teachers have moved from descriptive reflections to productive multi-perspective reflections, as is more commonly found in teaching experts (Bromme, 2014). Study 1, in particular, goes beyond the pre-existing body of research by not only examining trainees' capacity to reflect on a certain level, but shedding light on the kind of knowledge they use for reflection. After completion, for instance, trainees know more about what prior language knowledge and assumptions language learners may have (increase in learner knowledge) and can reflect on it (in detail Klempin, 2019). Since video-based reflections showed no difference, we therefore promote conducting a regular and time-efficient LLLS to support student teachers' reflection skills and didactic competencies.

## 6    LIMITATIONS AND IMPLICATIONS

Future research on teachers' reflective skills has to improve prognostic validity through longitudinal studies. We also need to map the 'absolute effects' in the classroom on learners in order to answer questions like: "Are errors more effectively fed back by reflective teachers? Is learning motivation higher in classrooms taught by reflective teachers?". Method triangulation, i.e. studies in which different instruments for didactic reflective competence measurement are combined, will be key in tackling the complexity of the construct and in securing construct validity. Findings of these two studies suggest that a class, in which student teachers have to approach theories in a reflective way and in which theories are applied in a complexity-reduced action space will be beneficial for supporting reflective skill developments in student teachers.

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