

# Teacher professional development interventions to promote data use in education

Citation for published version (APA):

Ansyari, M. F. (2023). *Teacher professional development interventions to promote data use in education*. [Doctoral Thesis, Maastricht University]. Maastricht University. <https://doi.org/10.26481/dis.20230116ma>

## Document status and date:

Published: 16/01/2023

## DOI:

[10.26481/dis.20230116ma](https://doi.org/10.26481/dis.20230116ma)

## Document Version:

Publisher's PDF, also known as Version of record

## Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

## General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

[www.umlib.nl/taverne-license](http://www.umlib.nl/taverne-license)

## Take down policy

If you believe that this document breaches copyright please contact us at:

[repository@maastrichtuniversity.nl](mailto:repository@maastrichtuniversity.nl)

providing details and we will investigate your claim.

# Summary

## Teacher Professional Development Interventions to Promote Data Use in Education

Muhammad Fauzan Ansyari

The main goal of this dissertation is to evaluate the role of professional development interventions (PDIs) in promoting data use. English proficiency is considered an important foreign language skill because it can bring personal, institutional, national or regional advantages. However, English proficiency is still low in many countries, including Indonesia, which calls for serious attempts to improve English language teaching (ELT) in these countries. Although curriculum innovations can help ELT improve English proficiency, their success depends very much on teachers as the main actors in classrooms; therefore, improving teachers' professional qualities is needed. Given the increasing need to make the teaching profession an evidence-based profession and to continuously improve it, the use of data is seen as a possible strategy. For effective data use, *data literacy for teaching* becomes a critical skill in addition to other professional knowledge and skills such as pedagogical content knowledge. However, teachers are often not well prepared for these skills. To address this issue, professional development activities are needed to help teachers develop *data literacy for teaching* so that they can use data to continuously improve their teaching and student learning and make ELT an evidence-based profession, similar to the medical profession.

To meet the goal, the objectives of this dissertation are directed toward 1) evaluating the effectiveness of teacher PDIs to promote data use, 2) investigating the characteristics of online teacher professional development (OTPD) for data use that may promote or hinder teachers' willingness to participate, and 3) examining the influence of teachers' individual characteristics on the degree of data use practice in classrooms. This dissertation consists of six chapters. Chapter 1 is the introductory chapter which describes the motivation of the dissertation. Chapters 2 and 3 report the effectiveness of data use PDIs from a global perspective by using systematic literature reviews and a meta-analysis. Chapter 4 provides evidence of the characteristics of OTPD for data use based on a discrete choice experiment. Using a decision tree analysis, Chapter 5 presents evidence of the influence of teachers' individual characteristics on the degree of data use practice in classrooms in the higher education context. The contents of each chapter are described below.

### Chapter 1

In this Chapter 1, we present the introduction and the motivation for the dissertation. The chapter highlights the importance of English proficiency and the current global proficiency index, including English proficiency and its challenges in Indonesia. It also presents strategies to improve English Language Teaching (ELT), including data use that potentially leads to continuous improvement and that makes ELT an evidence-based profession. In addition to equipping teachers with *data literacy for teaching*, the chapter also shows the role of PDIs in promoting data use. Following this, we provide the main goal of the dissertation as follows.

*Studying the role of professional development interventions (PDIs) in promoting data use.*

To achieve this goal, we formulate the following three objectives of the dissertation:

### Objective 1:

*Evaluating the effectiveness of teacher professional development interventions (PDIs) to promote data use.*

The first objective of the dissertation is to conduct two systematic literature reviews and a meta-analysis of studies that focus on PDIs for data use in various countries. It focuses on evaluating the effectiveness of the data use PDIs on teacher quality, instruction and student outcomes. Additionally, given that the effects of the PDIs are associated with the ways they are implemented, it also seeks to investigate the necessary characteristics or components that contribute to the effectiveness of the data use PDIs. This objective is discussed in Chapters 2 and 3 of this dissertation.

### Objective 2:

*Investigating the characteristics of online professional development (OTPD) for data use that promote or hinder teacher participation.*

Given that technological advancement allows for OTPD, it is important to examine the characteristics that promote or hinder teacher participation in OTPD by collecting data from university English teachers in Indonesian Islamic higher education. This objective is explored in Chapter 4 of this dissertation.

### Objective 3:

*Examining the influence of teacher individual characteristics on the degree of data use in classrooms.*

Teachers' individual characteristics play an important role in data use practices. Thus, understanding the most or least characteristics predicting the degree of teacher data use practice is important for clarifying the individual-level characteristics that contribute to data use practice. Using data from university English teachers in Indonesia, this issue is provided in Chapter 5.

## Chapter 2

This chapter provides a systematic literature review of the international literature studying the effects of PDIs for data use. In so doing, we developed a framework for evaluating data use PDIs that moves from the interventions themselves (input) to the practices of data use (process) and finally the outcomes (output). This framework was used as the theoretical underpinning of this review. Furthermore, the relevant studies were searched using several key terms in common databases that index educational articles: ERIC, Francis and Taylor Journal, Scopus, Springer and Wiley Online Library. The *Preferred Reporting Items for Systematic Reviews* (PRISMA) method was used to report the review process. We excluded articles addressing study contexts in non-formal or informal education, literature review articles, opinions and other non-field research articles. We only selected articles that reported data use PDIs for instructional purposes for in-service teachers in formal educational contexts at any educational level (pre-school, primary, secondary and tertiary), that were peer-reviewed, published between 2009 and 2019, employed a randomised experiment or quasi-experiment for causal inferences, and written in English. To check the quality of the articles, we used Petticrew and Roberts' (2006) eleven quality criteria. Based on this, we finally selected 17 articles for analysis. The results of the systematic review mainly showed the importance of incorporating some or all key characteristics of PDIs. The process of data use served as an improvement strategy with a three-part interrelated and cyclical process of intentionally using data to inform instruction. The process was also considered a constructivist learning process. Additionally, the results provided evidence of the promising effects of data use PDIs on teacher

satisfaction, data literacy, attitudes and beliefs, as well as student subject-related outcomes. However, the findings revealed that the effects on student outcomes were mediated by teacher outcomes, practices of data use and instructional changes. Despite these findings, there was no evidence in the studies that PDI features, teacher outcomes, practices of data use and instructional changes were, respectively, evaluated to support claims on their effects on student outcomes.

### **Chapter 3**

Chapter 3 also presents a systematic literature review and meta-analysis of international studies on the effects of PDIs for data use by aiming to investigate 1) the goals, dimensions and conditions of data use PDIs, and 2) the effect of data use PDIs on student outcomes. To these ends, we developed a framework for studying data use PDIs as the review's theoretical underpinning. In this chapter, we followed several phases for a conducting systematic review in the social sciences. First, we set the objective of the review, which was to identify the goals, dimensions and influencing conditions of data use PDIs. We then developed several broad terms, such as 'data use' and "data-based decision making" and used the terms for searching peer-reviewed articles in ERIC, Francis and Taylor Journal, Scopus, Springer and Wiley Online Library. Afterwards, we screened the articles based on titles. We included the studies focusing on PDIs that addressed data use for instructional purposes, studies reporting the effects of the PDIs on teacher outcomes, instruction or student outcomes, studies employing randomised experiments, quasi-experiments or other appropriate methods of (quasi-) causal inference, and studies being peer-reviewed and published between 2009 and 2019. We obtained 27 final articles for aim 1 and the selected articles were synthesised according to the theoretical framework. To achieve the second aim, we got 10 articles for a meta-analysis. The results suggested that conceptual, practical and continual goals are identified in data use PDIs. It is also found that facilitators of data use PDIs were supported by conceptual, practical or normative tools. They also employed a variety of techniques in facilitating teachers' data use through data teams or professional learning communities. The facilitation techniques include assessing needs, using models or modelling, observing performance, providing feedback, providing built-in time for reflection, and brokering. Further, the results highlighted the influence of several conditions that contribute to the success of the PDIs. Finally, the meta-analysis showed a significant positive effect of the PDIs on student outcomes, with an effect size of 0.17.

### **Chapter 4**

This chapter reports on teachers' preferences for online professional development programmes (OTPD) for data use by analysing how interaction mode/format, learning material mode, learning strategy, duration, certificate, and cost affect English teachers' decision to participate in an OTPD programme for instructional data use. We conducted a discrete choice experiment (DCE) to elicit university English teachers' preferences for OTPD programmes for instructional data use. As a quantitative method, DCE can be used to elicit individuals' preferences for product, service or programme characteristics, to quantify the relative importance or strength of the characteristics of a product, service or programme and to determine potential uptake rates of the characteristics. In this study, we used a DCE survey with seven choice sets presented via an online survey platform Qualtric. Each set had two alternatives to the OPDP programmes. Programme A and B had similar characteristics in terms of interaction, learning material, learning strategy, duration, certificate, and cost. The difference between the two programmes was on the levels describing each of the characteristics. The seven choice sets, one by one, were shown to teachers and then we asked them to choose one out of two scenarios/programmes offered to them. In case teachers did not have any preference over the two programme alternatives, they could choose an opt-out option. Furthermore, relying on 330 data collected from university English teachers in Indonesia, we used a mixed logit model to analyse teachers' preferences. The results showed that the uptake of the OTPD programme for data use is positively influenced by using interaction mode. The English

teachers were willing to participate in the OTPD programme that employed mostly synchronous online interaction but were reluctant to participate in the OTPD programme that was not free of charge, that did not provide a certificate upon completion, was longer in duration, and used mostly digital reading materials (e.g., pdf readings), respectively. Moreover, the subgroup analysis indicated that teachers aged 41 years or older and those who had less OTPD experience were not willing to participate in the OTPD programme that employed mostly an individual learning strategy. We also found in the subgroup analysis that the negative effect of the OTPD programme without certificates was stronger for 40 years or younger teachers, female teachers as well as teachers with more OTPD experience.

## Chapter 5

This chapter examines the role of data literacy, content knowledge, pedagogical knowledge, general English proficiency and English-for-teaching in predicting the degree of instructional data use in the context of teaching English in Indonesian higher education institutions. To this end, we developed a questionnaire based on the literature and distributed it online using an online survey platform Qualtric to collect data nationally from university English teachers. The target sample was drawn from 58 language centres in state Islamic higher education institutions in Indonesia. Given that our data were not normally distributed, we analysed 204 data using a supervised machine learning approach by employing a decision tree (classification) analysis. A decision tree analysis is a non-parametric method that allows for identifying different predictors and their interactions. It also supports both nominal and categorical variables and the results are presented in graphical forms or rules that can help to provide easily interpretable and useful insights. The results showed that pedagogical knowledge, data literacy, content knowledge, English-for-teaching, and attitudes toward data all predicted the degree of the university English teachers' practice of instructional data use. Among those characteristics, pedagogical knowledge was the best predictor while general English proficiency did not seem to influence the degree of instructional data use practice. In particular, teachers with more pedagogical knowledge were more likely to practise instructional data use while those with lower pedagogical knowledge required additional knowledge and skills for more frequent practice.

## Chapter 6

Finally, Chapter 6 concludes the dissertation by discussing the main findings from the studies conducted in the dissertation. The chapter starts off by revisiting the motivation and problem statement of the dissertation. The chapter then discusses the main findings of the dissertation presented in five statements below.

1. *There is evidence that supporting teachers through professional development interventions effectively leads to increased student learning outcomes.*
2. *In addition to the core and structural characteristics of professional development, the roles of facilitators and artefacts are crucial for data use professional development interventions.*
3. *Intervention characteristics are crucial for both the effectiveness of the intervention and teachers' willingness to participate.*
4. *Effective professional development for data use improves teacher outcomes which further determine different degrees of data use practice.*
5. *As many factors influence data use, this indicates a need for a systems approach to professional development interventions for data use.*

In addition to these statements, this last chapter presents the limitations and contributions of the dissertation. First, the data or samples of this dissertation are not fully internationally

representative; therefore, our findings may not be generalisable in international contexts. Despite this, our findings contribute to the existing literature by providing how professional development can support the development of teachers' data use to improve instruction and student learning. Our evidence on the various effects, essential characteristics of both in-person and online professional development, and individual teachers' characteristics determining the practice of data use can give insights into how data use PDIs can guide policymakers or professional development providers to support teachers through PDIs. Second, we are unable to provide specific evidence on the effects of data use PDIs on English teachers' qualities. Notwithstanding this limitation, this dissertation is among the first studies reporting teachers' preferences for online professional development for data use and teachers' characteristics determining data use practice in ELT. So, our findings are useful initial insights that can be used as theoretical foundations for further research in response to the lack of research evidence in the existing literature. Third, the findings of this dissertation are not nuanced in terms of the intervention type. Our findings are limited to giving insights into the intervention through professional development, they cannot be brought into the other types of interventions. Given this limitation, our findings are derived from several methods, including systematic literature reviews, a meta-analysis, a discrete choice experiment and a decision tree analysis, we argue that using those different methods can give more robust or at least nuanced evidence than using a certain method only. Finally, our evidence of impact is derived from studies in the context of primary and secondary education and it may not be generalisable in higher education settings. However, we are able to include some insights from higher education about the important characteristics of the OTPD and teachers' individual characteristics determining data use practice.