Check for updates

# The impact of teaching materials on instructional design and teacher development

Lola Garay Abad[1]* and John Hattie[2]

[1]Eduki, Berlin, Germany, [2]Melbourne Graduate School of Education, University of Melbourne, Parkville, VIC, Australia

**Introduction:** Teaching materials are more than just classroom tools — they shape how teachers teach and how they grow professionally. While widely used, their impact across different stages of a teacher's career has received limited attention. This study explores how different types of materials support both instructional design and professional development, revealing their evolving role across a teacher's journey.

**Methods:** We conducted a large-scale survey ($n$ = 2,585) of German-speaking educators, all active users of an online educational platform (eduki). The survey included Likert-scale and open-ended items on material usage, instructional impact, professional growth, and classroom confidence. We analyzed the results using factor analysis and MANOVA to identify patterns and differences across career stages.

**Results:** Findings show that instructional impact is highest among trainees (mean = 3.55), while the influence on professional growth increases with experience, peaking among very experienced teachers (mean = 3.91). Teacher-created materials were rated as most useful (90.1%), and teachers reported high autonomy (94.1%) in selecting and adapting materials — a factor closely tied to increased classroom confidence. Two strongly correlated factors emerged from the analysis: "Instructional Effectiveness" and "Improve Me as a Teacher."

**Discussion:** Rather than plateauing over time, professional development remains vibrant — and even deepens — with experience. Teaching materials play a key role not only in early-career structure but also in later-career reflection and refinement. Empowering teachers to select and adapt resources appears to strengthen both instructional design and long-term growth, challenging traditional linear models of teacher development.

# 1 Introduction

Teaching materials are fundamental educational tools, influencing instructional practices and teacher development (Bouckaert, 2018; Hattie, 2023). While previous research has explored their role in supporting classroom instruction (Ball and Cohen, 1996; Darling-Hammond, 2016), less attention has been paid to their impact of using materials on teacher professional development across career stages. This study addresses this gap by examining how teachers at different career stages interact with and benefit from teaching materials, both for instructional purposes and professional growth.

The significance of this research lies in its potential to inform more effective design and implementation of teaching materials and guide professional development strategies that

employ these materials optimally across the trajectory of a teacher's career. By understanding how materials impact novice and experienced teachers, we can better support the continuous growth and effectiveness of teaching as a profession. This research explores the complex relationship between teaching materials, teacher professional growth across career stages, and teacher agency. By examining how instructional resources influence both instructional design and professional development, the study challenges traditional assumptions about linear professional growth and highlights the evolving needs of teachers over time. A key focus is the role of teaching materials in promoting educational equity, particularly through teacher-generated content, which has proven effective in addressing resource disparities across diverse educational settings.

This study draws on several key theoretical concepts to frame its investigation:

1. Pedagogical Content Knowledge (PCK) (Shulman, 1987): PCK represents the unique blend of content knowledge and pedagogical knowledge that teachers develop. More recent work by Chan and Yung (2018) extends this concept by emphasizing that PCK development involves more than just experience or subject knowledge, it requires active engagement with new topics, teaching strategies, and learning contexts. Our study examines how teaching materials contribute to the development and refinement of PCK across career stages.
2. Teacher agency (Biesta and Tedder, 2006): we explore how teachers exercise agency in selecting, adapting, and creating teaching materials and how this agency relates to their professional growth.
3. Professional capital (Hargreaves and Fullan, 2012): this concept emphasizes the cumulative nature of professional expertise. We investigate how teaching materials contribute to the accumulation of professional capital throughout a teacher's career.
4. Situated learning (Lave and Wenger, 1991): we consider how teacher-generated materials and community-based sharing platforms (specifically https://eduki.com/) create opportunities for situated learning within professional communities.
5. Educational equity (Darling-Hammond, 2010): our study examines the potential of teaching materials, particularly teacher-generated content, to address disparities in educational resources and outcomes.
6. Continuous professional learning (Guskey, 2002): we explore how engagement with teaching materials supports ongoing professional development and challenge assumptions about career phases.

This study aims to address the following primary research questions: (1) How does the impact of teaching materials on instructional design vary across different stages of a teacher's career? (2) What is the relationship between teaching materials and professional development throughout a teacher's career trajectory? (3) How do teachers at different career stages use, adapt, and create teaching materials? (4) To what extent do teaching materials contribute to educational equity and teacher agency? And (5) How do different types of teaching materials (e.g., teacher-generated, publisher-produced, institution-created) impact teacher confidence and classroom effectiveness?

# 2 Literature review

## 2.1 Teaching materials as catalysts for instructional and professional growth

The role of teaching materials in shaping instructional practices has been a subject of ongoing research in education. Ball and Cohen (1996) emphasized the potential of curriculum materials to be key agents in improving classroom instruction, arguing that well-designed materials support teachers in making instructional decisions and adapting to the needs of diverse learners. While previous research has focused on the general impact of teaching materials, fewer studies have examined their role in teacher development across career stages. Huberman (1989) identified distinct phases in teachers' professional lives, from early career survival to later-stage mastery and renewal, suggesting that their needs and reliance on instructional resources evolve over time. Berliner (2004) further distinguished between novice and expert teachers, highlighting how experienced educators internalize planning processes and rely less on structured materials compared to early-career teachers, who depend more on externally designed resources for lesson planning and instructional guidance. Sahin-Taskin (2017) provides empirical evidence that novice teachers create more detailed lesson plans, incorporating explicit instructional strategies, whereas experienced teachers modify and adapt materials more fluidly based on their classroom contexts. These findings suggest that teaching materials not only support instructional design but also serve different professional development functions at various career stages. This perspective aligns with our study's aim to investigate how materials impact teachers' instructional decisions and professional growth over time.

## 2.2 Professional development and teacher learning

The field of teacher professional development has seen significant evolution in recent years. Guskey (2002)'s model of teacher change emphasizes the importance of professional development that leads to changes in classroom practices, ultimately resulting in improved student outcomes. This model provides a framework for understanding how engagement with teaching materials might contribute to ongoing professional growth. Darling-Hammond and Bransford (2005)'s comprehensive work on preparing teachers for a changing world highlighted the need for continuous learning opportunities throughout a teacher's career. Their research emphasized the importance of providing teachers with tools and resources that support their ongoing development, aligning closely with our investigation into how teaching materials fulfill this role.

Similarly, Hargreaves and Fullan (2012)'s concept of professional capital offers a valuable lens for examining teacher development. They argue that professional capital is built through a combination of human capital (individual skill and capability), social capital (collaborative power of the group), and decisional capital (ability to make discretionary judgments). Our study explores how teaching materials might contribute to developing these forms of capital across a teacher's career.

Technology has played a major role in many designs of instructional materials and professional development of teachers. There are many websites that provide lesson plans, and some can tailor

these plans to diverse learner needs and aligned with curriculum standards, and often include videos, simulations, virtual labs, adaptive assessments, and collaborative learning exercises into their teaching materials (Mishra and Koehler, 2006; Roschelle et al., 2010). Such sites include Share my Lesson (www.sharemylesson.com), Teachers Pay teachers (www.teacherspayteachers.com), CommonLit (www.commonlit.org), Khan academy (www.khanacademy.org), OER commons (www.oercommons.org), LehrerOnline (www.lehrer-online.de), and *eduki* (eduki.com). The latter is the focus of this study. Many also include real-time feedback on student performance (Siemens and Long, 2011), and more recent sites include aspects of artificial intelligence such as Brisk Teaching (www.briskteaching.com), MagicSchool (magicschool.ai), LessonPlans.ai (www.lessonplans.ai), Ghostwriter AI (www.ghostwriter.ai).

Recent work by Suartama et al. (2024) emphasizes the need for instructional design models that bridge formal, informal, and social collaborative learning through technology-rich environments. Their *pervasive learning environment (PLE)* framework illustrates how learning can be extended beyond structured coursework into informal and socially embedded practices, supported by platforms such as learning management systems and social media. Although our study does not evaluate a specific learning design model, teachers' adaptive use of self-created and community-shared materials on *eduki* reflects a similar convergence. Teachers blend formal lesson planning with informal peer learning and social validation, suggesting that digital material ecosystems like *eduki* may function as de facto PLEs, especially when teachers exercise high agency in selecting and modifying content.

## 2.3 Teacher agency and material adaptation

The concept of teacher agency has gained prominence in educational research, particularly concerning curriculum implementation and material use. Priestley et al. (2015) argued for an ecological understanding of teacher agency, where agency is seen as something achieved rather than possessed. This perspective is crucial for our study as we examine how teachers exercise agency when interacting with teaching materials. Campbell (2019) introduced the concept of "pedagogical bricolage," describing how teachers use their agency to creatively combine and adapt various resources to meet the needs of their students. This idea resonates with our investigation into how teachers at different career stages modify and utilize teaching materials.

There has been a long-held set of claims opposing the use of textbooks in schools, as some argue that it negates the teacher agency's ability to choose the optimal resources for their class. Apple and Christian-Smith (2017) documented how the politics of selecting textbooks can overtly create a cultural reality that emphasizes the state's version of what constitutes essential knowledge and a legitimate worldview. The downside of not using textbooks is the extra time and commitment placed on teachers to find, adapt, and integrate resources and lesson planning. Given the rise and ease of access to the internet, it is thus no surprise that the greatest source of these resources is Pinterest and YouTube. Frank et al. (2018) noted 87% of teachers used Pinterest in lesson planning and delivery of instruction. When materials from these sites are used to develop skills to remember or memorize facts, then learning decreases over time. However, learning

is more likely to increase when they are curated to develop understanding and apply knowledge (Knake et al., 2021).

## 2.4 Educational equity and teaching materials

The role of teaching materials in promoting educational equity has been of growing interest. Darling-Hammond (2010)'s work on educational equity highlights the importance of access to high-quality educational resources in reducing disparities in student outcomes. Cochran-Smith and Lytle (2009)'s research on practitioner inquiry emphasizes the value of teacher-generated knowledge in addressing educational challenges. This work provides a foundation for the current exploration of how teacher-created materials might serve as a vehicle for sharing context-specific expertise and promoting equity.

## 2.5 Career stage differentiation in teacher development

The notion that teachers' needs and abilities change throughout their careers is well-established in educational research. Berliner (2004)'s work on expert teachers provides a framework for understanding how teachers progress from novice to expert status, with implications for how they might interact with and benefit from teaching materials differently at various stages. Huberman (1989)'s seminal study on the professional life cycle of teachers offers insights into the different phases of a teacher's career, from survival and discovery in the early years to experimentation and activism in mid-career, and serenity or disengagement in later years. This model provides context for our investigation into how the impact of teaching materials might vary across these career phases.

Hatch and Clark (2021) in a study of rural experienced teachers noted that they did not write elaborate lesson plans preferring to focus more on various teaching strategies, disciplined improvisation, knowledge of their students, and formal and informal assessment to drive their classrooms. Experienced teachers are more 'disciplined improvisers" (Sawyer, 2004). Teachers earlier in their careers tend to write longer, more comprehensive plans, including explicit teaching strategies, learning activities, and assessment tasks, but often have more difficulty aligning curriculum, assessment, and reporting requirements (Sahin-Taskin, 2017). More experienced teachers use fewer words and less detail in their written plans (if they write them at all). They have much more internalized planning, allowing for more potential barriers and enablers to adapt their planning to classroom dynamics and student needs (Griffey and Housner, 1991; Krepf and König, 2023).

## 2.6 Research gaps and study rationale

While existing literature provides a rich foundation for understanding teachers' selection of teaching materials, several gaps remain. There is insufficient exploration of how the impact of teaching materials varies across teacher career stages, a lack of large-scale studies examining teacher perceptions and use of materials across different contexts, and limited investigation into the role of teacher-generated materials in promoting educational equity and teacher agency. This

study addresses these gaps by providing a comprehensive analysis of how teaching materials impact teachers across their career trajectories, with implications for both practice and policy in education.

# 3 Methodology

This study employed a quantitative approach, allowing for a comprehensive examination of the complex relationship between teaching materials, instructional design, and professional development across different career stages.

Data was collected between March and May 2024 through an online questionnaire. There were 5,695 *eduki* users (www.eduki.com) and about half completed the survey (45.4%). The questionnaire consisted of 11 Likert-scale items addressing: Material selection and usage pattern, impact on instructional practices, contribution to professional development, teacher agency and autonomy, and confidence in material selection and adaptation.

The survey included several key measures: instructional design impact (assessed on a 4-point scale); professional growth impact (measured on a 4-point scale); material source preferences (participants rated the usefulness of materials from various sources, such as teacher-generated, publisher-produced, and institution-created); teacher agency (measured through questions about autonomy in material selection and adaptation); and classroom confidence (assessed concerning different types of teaching materials). Respondents were also asked to identify their teaching experience, categorized into four career stages: trainee (less than 2 years), early career (2–5 years), experienced (6–10 years), and very experienced (10 + years).

The analyses were conducted through a multi-stage process. The results outline the descriptive statistics across the career stages, an analysis of the open-ended responses to identify themes and patterns, a maximum-likelihood factor analysis, and then a multivariate analysis of variance based on the two major factors identified in the factor analysis.

The study adhered to European Commission ethics guidelines (2013) and relevant legislation for data processing. Participant anonymity was maintained throughout the data collection and analysis process.

# 4 Findings

## 4.1 Participant demographics and perceptions of teaching materials

The study includes 2,594 German-speaking teachers who are users of the *eduki* platform. *eduki* is an online marketplace where educators can access, create, and share teaching materials. Participants were recruited through the *eduki* platform via direct invitations and voluntary survey participation.

The survey sample included teachers from Germany (82.4%), Austria (8.8%), Switzerland (4.7%), Western Europe (2.7%), Eastern Europe (0.4%), and other European regions (0.4%). Educators were classified into four career stages: 342 trainees (within initial teacher education), 557 early career teachers (2–5 years' experience), 445 experienced teachers (6–10 years), and 1,165 very experienced teachers (10 + years). Additionally, 85 participants were categorized under an "Other" category, which included mixed roles, administrative positions, or individuals who did not specify their career stage. While

some internal response counts summed to 2,594, the survey officially recorded 2,585 valid respondents, reflecting minor variations due to response patterns or rounding.

The dominant teaching levels included kindergarten (<5 years, 1.6%), primary education (6–11 years, 57.5%), secondary I (57.5%), and secondary II (27.3%), with 1.4% of respondents not specifying their teaching level. Percentages exceed 100% because some teachers reported teaching across multiple school levels. The majority of participants were female (92.5%).

Overall, 96.8% of teachers reported that the materials on *eduki* enhanced their teaching, while 94.1% indicated that these resources helped them save time in lesson preparation. Additionally, 84.7% agreed that the materials supported them in planning lessons effectively. The highest-rated items on a five-point Likert scale included "they complement my teaching" (4.37), "they save me time when preparing lessons and teaching" (4.36), "they provide a variety of tasks and content" (4.09), and "the learners like them" (3.87).

Conversely, the lowest-rated items provide insight into the nuanced ways teachers evaluate educational materials. In this Likert scale, higher scores indicate stronger agreement, while lower scores reflect weaker agreement with an item's usefulness. Specifically, "self-created materials" received a mean rating of 2.08, followed by "trust and use of colleague recommendations" (2.25), "materials created by colleagues" (2.48), and "materials created by the teaching community" (2.52).

This seemingly paradoxical result—where teacher-generated materials are valued in some contexts but received lower ratings in others—suggests a complex dynamic in how teachers assess and utilize instructional resources. One plausible explanation for this apparent contradiction lies in the context-specific demands of teaching. While a significant proportion of teachers (90.1%) express a preference for generating and adapting their own materials, they may exhibit greater criticality when assessing these materials against defined evaluative criteria. This tendency extends to the materials produced by immediate colleagues, suggesting that familiarity with the source may prompt more rigorous scrutiny rather than leniency. Such findings resonate with Hargreaves and Fullan (2012)'s framework of professional capital, which posits that teachers uphold high professional standards and engage in critical self-reflection, particularly when evaluating their own work or that of their peers.

Furthermore, the low rating assigned to "trust and use of colleague recommendations" (2.25) underscores the importance of professional autonomy in the selection of instructional materials. Teachers may prefer to directly assess the quality and relevance of resources rather than rely on peer endorsements, highlighting their commitment to independent judgment and individualized decision-making in pedagogical practices. This inclination reflects an underlying professional ethos that values both critical engagement and personal accountability in the curation and application of educational content.

## 4.2 Factor analysis of teaching material impact: instructional effectiveness vs. teacher improvement

A maximum-likelihood factor analysis specifying a correlated solution (Promax) identified two interpretable factors. While these two factors (Instructional Effectiveness and Improvement as a Teacher) emerged as distinct constructs, their high correlation

TABLE 1 Factor loadings for perceived impact of teaching materials on instructional effectiveness and improvement as a teacher.

| Item statement | Factor 1: instructional effectiveness | Factor 2: improve me as a teacher |
|---|---|---|
| Define important concepts. | 0.73 | −0.11 |
| To plan my lessons effectively. | 0.68 | 0.00 |
| They show how learners can achieve specific results. | 0.53 | 0.07 |
| They put learning in an order/sequence. | 0.51 | 0.06 |
| To make me think about my teaching style, my beliefs and my techniques. | 0.45 | 0.16 |
| Taking different learning needs into account. | 0.36 | 0.27 |
| The learners like to use them. | 0.05 | 0.69 |
| They complement my teaching. | −0.11 | 0.65 |
| They save me time when preparing lessons and teaching. | −0.10 | 0.61 |
| I develop professionally by using them. | 0.21 | 0.53 |
| They are better than the materials I can create. | 0.09 | 0.50 |
| Provide a variety of tasks/content. | 0.29 | 0.32 |
| Factor intercorrelation | | |
| Effective instructional design: | 1.00 | |
| Improve me as a teacher: | 0.70 | 1.00 |

TABLE 2 Percentage of teachers opting for their top preferences (rated 4 or 5) regarding the source of lesson materials.

| Material source | % with 4 or 5 |
|---|---|
| Material created and uploaded on *eduki* | 90.1% |
| Self-created resources | 89.8% |
| Materials created by colleagues in my school | 75.5% |
| Materials from publishers | 70.1% |
| Recommended by teachers I know and trust | 57.9% |
| Created by authors still actively teaching | 53.0% |
| Highly rated by teaching community (e.g., star rating) | 49.9% |
| Created by an author I know or trust | 45.5% |
| State/institutional produced materials | 38.6% |
| Recommended by my school/state | 33.5% |

($r = 0.70$) suggests a significant overlap (Table 1). This raises the question of whether instructional effectiveness directly contributes to perceived professional growth, or if professional development leads to improved instructional design over time. The first factor focuses on the pedagogical and professional value of teaching materials in enhancing teacher efficacy and professional growth, and the second factor focuses on the practical advantages and appeals to learners of the professional material, enhancing both teaching

efficiency and classroom engagement. Factor 1, termed "Instructional Effectiveness," emphasizes the utility of teaching materials in achieving teaching results, conceptual clarity, lesson planning, and professional development. Factor 2, "Improve me as a teacher" reflects teaching materials' practical benefits for teachers and their appeal to students. It highlights materials' time-saving nature, ability to complement teaching, and student enjoyment.

The estimates of reliability (coefficient alpha) were sufficiently high to provide confidence using the scores on the two factors (Instructional effectiveness alpha = 0.81, Improves me as teacher alpha = 0.77).

The teachers preferred material created by themselves or by *eduki* (that is, scored 4 or 5 on the Likert scale of preference) and the choice of *eduki* is not surprising given the samples were selected because they had chosen to come to the site. But it is still satisfying to see such a high rating (Table 2).

The differentiation between the top and bottom columns of Table 2 reflects the sources of trust and familiarity teachers associate with materials. These differences can be analyzed based on two primary dimensions: familiarity and personal relevance versus external authority or institutional endorsement. The most trusted sources relate to familiarity and personal relevance. These include resources teachers have created, collaborated with colleagues, or sourced from trusted platforms like *eduki*. The less trusted sources include resources schools, states, or broader communities recommended. They are probably seen as more generic, less trusting, and not aligned with personal needs. Overall, teachers prefer material they have a hand in creating or come from close and trusted sources, while materials from institutional or broader community sources are less favored.

## 4.3 Impact across career stages

Table 3 presents the mean scores for the two major factors across different schooling levels. A MANOVA revealed statistically significant differences (Wilks Lambda = 0.986, Mult. $F = 4.64$, df = 8, 5,158, $p < 0.001$). Instructional Effectiveness and Improve me as a Teacher scores were slightly higher for kindergarten teachers, with minimal variation across other schooling levels. However, no statistically significant differences were found in relation to years of experience (Wilks Lambda = 0.995, Mult. $F = 1.89$, df = 6, 5,008, $p = 0.078$). Regardless of experience level, teachers derive substantial professional development benefits from their choice of materials.

TABLE 3 Summary statistics for the two factors relating to levels of schooling.

| School level | Instructional effectiveness | SD | Improve me as a teacher | SD | N |
|---|---|---|---|---|---|
| Kindergarten | 3.98 | 0.77 | 4.23 | 0.69 | 41 |
| Primary | 3.50 | 0.64 | 3.94 | 0.69 | 1,486 |
| Secondary I | 3.46 | 0.67 | 3.86 | 0.70 | 707 |
| Secondary II | 3.41 | 0.68 | 3.82 | 0.69 | 306 |
| Average | 3.49 | 0.66 | 3.90 | 0.70 | 2,585 |

TABLE 4  Summary statistics for the two factors relating to years of experience.

| Career stage | Instructional effectiveness | SD | Improve me as a teacher | SD | N |
|---|---|---|---|---|---|
| Initial teacher education | 3.56 | 0.71 | 3.89 | 0.71 | 341 |
| Early career (2–5 years) | 3.47 | 0.63 | 3.89 | 0.67 | 557 |
| Experienced (6–10 years) | 3.46 | 0.64 | 3.89 | 0.71 | 445 |
| Very experienced (> 10 years) | 3.47 | 0.65 | 3.92 | 0.69 | 1,165 |
| Average | 3.48 | 0.66 | 3.90 | 0.69 | 2,509 |

TABLE 5  Perceived impact of teaching materials across career stages (mean ratings on a 4-point scale).

| Item statement | Initial teacher education | Early career (2–5 years) | Experienced (6–10 years) | Very experienced (> 10 years) | Total |
|---|---|---|---|---|---|
| Achieve teaching results. | 3.56 | 3.47 | 3.50 | 3.44 | 3.47 |
| Define important concepts. | 3.35 | 3.24 | 3.18 | 3.19 | 3.22 |
| To plan my lessons effectively. | 3.82 | 3.71 | 3.66 | 3.62 | 3.68 |
| They show how learners can achieve specific results. | 3.36 | 3.27 | 3.28 | 3.35 | 3.32 |
| They put learning in an order/sequence. | 3.68 | 3.68 | 3.63 | 3.65 | 3.66 |
| To make me think about my teaching style, my beliefs and my techniques. | 3.57 | 3.36 | 3.43 | 3.39 | 3.42 |
| Taking different learning needs into account. | 3.76 | 3.78 | 3.78 | 3.74 | 3.76 |
| The learners like to use them. | 3.96 | 3.84 | 3.80 | 3.88 | 3.87 |
| They complement my teaching. | 4.29 | 4.42 | 4.38 | 4.37 | 4.37 |
| They save me time when preparing lessons and teaching. | 4.25 | 4.32 | 4.33 | 4.34 | 4.32 |
| I develop professionally by using them. | 3.50 | 3.39 | 3.39 | 3.39 | 3.40 |
| They are better than the materials I can create. | 3.18 | 3.28 | 3.33 | 3.44 | 3.35 |
| Provide a variety of tasks/content. | 4.17 | 4.09 | 4.10 | 4.07 | 4.10 |

The perceived impact of teaching materials remains relatively stable across years of experience, with only minor variations. However, as shown in Table 4, very experienced teachers (10 + years), reported slightly higher professional growth scores (3.92) compared to early-career teachers (3.89), suggesting that teaching materials continue to play a role in professional development initial training.

When analyzed by experience level, five key patterns emerge. More experienced teachers report that the resources they find are superior to those they can create, citing time savings as a primary benefit. In contrast, less experienced teachers highlight that materials help them effectively plan lessons, define key concepts, and engage learners (Table 5).

There were statistical differences in the country in which the teachers were working (Wilks Lambda = 0.989, Mult. $F = 4.74$, df = 6, 5,162, $p < 0.001$). However, the practical magnitude of the effects is small, with teachers in Austria with slightly higher means on both factors compared to their peers in Germany and Switzerland (Table 6).

## 4.4 Subject specific analysis

We grouped the disciplines into two major themes: Academic/Theoretical Disciplines and Applied/Creative/Practical Disciplines. The average differences between these two groups were minimal, with effect sizes of 0.06 for Instructional Effectiveness and 0.05 for Improvement as a Teacher. This suggests that, despite variations across

TABLE 6  Summary statistics for the two factors relating to the country of the school.

| Country | Instructional effectiveness | SD | Improve me as a teacher | SD | N |
|---|---|---|---|---|---|
| Austria | 3.66 | 0.75 | 4.02 | 0.72 | 341 |
| Germany | 3.46 | 0.64 | 3.88 | 0.69 | 557 |
| Switzerland | 3.54 | 0.63 | 3.98 | 0.63 | 445 |
| Other | 3.62 | 0.72 | 4.06 | 0.73 | 1,165 |
| Average | 3.48 | 0.66 | 3.90 | 0.69 | 2,509 |

subjects, teachers generally perceive instructional materials as similarly effective across both academic and applied fields. The detailed mean ratings and standard deviations for each subject area are presented in Table 7.

While there are some variations across disciplines, the differences remain relatively small for most subjects. Scores for Instructional Effectiveness range from 3.45 to 3.49, while Improvement as a Teacher ratings range from 3.85 to 3.93, indicating consistent teacher satisfaction with educational materials across disciplines.

Language-related subjects and Mathematics received the highest ratings, suggesting that teachers in these areas perceive instructional materials as particularly effective for both classroom

TABLE 7 Summary statistics for subject taught.

| Academic and theoretical disciplines | Instructional effectiveness | SD | Improve me as a teacher | SD | N |
|---|---|---|---|---|---|
| Other foreign languages | 3.49 | 0.66 | 3.93 | 0.64 | 132 |
| English as foreign language | 3.48 | 0.66 | 3.93 | 0.66 | 747 |
| Mathematics | 3.49 | 0.66 | 3.90 | 0.65 | 1,336 |
| Language (German literature, writing) | 3.48 | 0.62 | 3.91 | 0.68 | 1,548 |
| Social sciences | 3.47 | 0.66 | 3.88 | 0.68 | 803 |
| Natural sciences | 3.45 | 0.64 | 3.87 | 0.69 | 739 |
| Computer science/ Technology | 3.46 | 0.70 | 3.85 | 0.68 | 231 |

| Applied, Creative and Practical Disciplines | Instructional Effectiveness | SD | Improve me as a teacher | SD | N |
|---|---|---|---|---|---|
| Sports | 3.48 | 0.62 | 3.92 | 0.67 | 624 |
| Visual arts (art, music, theatre) | 3.46 | 0.63 | 3.91 | 0.68 | 1,066 |
| Special education | 3.48 | 0.64 | 3.88 | 0.71 | 403 |
| Vocational/Technical | 3.33 | 0.61 | 3.74 | 0.68 | 91 |

teaching and professional development. Specifically, Other Foreign Languages (3.49/3.93), English as a Foreign Language (3.48/3.93), and Mathematics (3.49/3.90) were among the top-rated subjects.

In contrast, Vocational/Technical education received the lowest ratings for both factors (3.33 for Instructional Effectiveness and 3.74 for Improving as a Teacher). This suggests that teaching materials in vocational subjects may not be perceived as equally impactful as those in traditional academic fields. Applied disciplines, such as Sports (3.48/3.92) and Visual Arts (3.46/3.91), maintained high ratings for professional growth, suggesting that creative and physical education subjects are valued for teacher development. This is possibly need for more specialized or practical materials that align with hands-on learning, differences in instructional methodologies compared to theoretical subjects, and challenges in integrating vocational resources into standardized curricula.

The standard deviations (SD) were relatively stable across subjects, generally ranging between 0.61 and 0.71, indicating moderate agreement among respondents. The highest variability was observed in Special Education (SD = 0.71 for teacher improvement), suggesting more diverse perceptions in this field.

## 4.5 Effect size and key takeaways

The effect size difference between academic and applied subjects was 0.06 for Instructional Effectiveness and 0.05 for Improvement as a Teacher, indicating only minor variations between these two broad categories (Table 7). This suggests that teaching materials, regardless of subject area, serve broadly similar functions in supporting instruction and professional growth. However, the distinct pattern observed in Vocational/Technical education warrants further investigation.

These insights highlight the overall effectiveness of teaching materials across diverse subjects while underscoring the need for specialized resources in vocational education to enhance its perceived impact on teaching and professional growth.

## 4.6 Material adaptation requirements

Teachers reported high levels of professional autonomy, with 94.1% indicating they have freedom in selecting materials, and 83.6% expressing confidence in their ability to adapt materials to meet student needs. This suggests a robust level of professional agency in material selection and modification.

The analysis of material adaptation highlights a distinct pattern in how teachers modify instructional resources based on their career stage and the source of the materials. The data reveals a strong correlation between the proximity of material creation to classroom practice and the extent of adaptation required. Early-career teachers frequently adjust materials to better align with instructional needs, engaging in exploratory adaptation as they experiment with different teaching approaches. In contrast, experienced teachers demonstrate selective refinement, making targeted modifications rather than completely restructuring resources. This shift reflects progression from creative adaptation in the early years to strategic expertise, where seasoned educators draw on their experience to fine-tune materials with minimal adjustments.

The required adaptation levels show a consistent pattern across different material sources:

1  Classroom-proximate material: materials created closest to the classroom environment require the least adaptation:
- Self-created materials demonstrate the highest ready-to-use rate (66.3% needed little to no adaptation)
- Teacher-community materials (51.1% needed little to no adaptation)
- Colleague-created materials (52.1% needed little to no adaptation)
2  Publisher-produced materials: commercial materials show increased adaptation requirements:
- Publisher materials require some level of modification in 75.7% of cases
- This suggests a gap between commercial material design and classroom implementation needs

3 Institutional materials: materials created at the institutional level require the most significant modification:

- Institution-created materials need substantial adaptation (87.3%)
- This finding raises questions about the effectiveness of top-down approaches to material development

This pattern suggests that the further removed the material creator from the classroom context, the more adaptation is required to make the resources effective for specific teaching situations. This finding aligns with Hargreaves and Fullan (2012)'s concept of professional capital, which emphasizes the importance of teacher expertise and classroom-level knowledge in educational resource development.

These data indicate potential inefficiencies in current material development processes, particularly for resources created at institutional levels. This suggests a need to reconsider how educational materials are developed and distributed, potentially incorporating more teacher input and classroom-level perspectives during the creation process.

## 4.7 Impact on teaching practice, professional development, and classroom confidence

The relationship between material sources and their impact reveals three distinct but interrelated dimensions: instructional design effectiveness, contribution to teacher development, and influence on classroom confidence. In this study, classroom confidence refers to teachers' perceived sense of preparedness, effectiveness, and self-assurance in using instructional materials to support their teaching.

First, there is an inverse relationship between institutional distance and classroom confidence. While state/institutional materials show the highest impact on instructional design (3.62), they generate the lowest confidence ratings, with only 30.5% of teachers finding them highly useful in boosting their confidence in the classroom. Conversely, self-created materials score lowest on instructional design (3.38) but produce the highest confidence ratings, with 79% of teachers reporting they feel highly confident using them (Figure 1).

Interestingly, "Improve me as a Teacher" scores remain remarkably consistent (ranging from 3.83 to 4.0) across all material sources. This suggests that the act of engaging with teaching materials—regardless of their origin—plays a greater role in professional development than the material source itself. Teachers evaluate, adapt, and personalize materials to fit their needs, which may explain why professional growth remains stable across different sources.

Community-created materials (such as those found on *eduki*) appear to strike a balance between structural support and practical utility. They achieve moderate instructional design scores (3.45), strong teacher improvement ratings (approximately 3.90), and high confidence impacts, with 70% of teachers finding them extremely useful for increasing their confidence in using instructional materials.

These findings suggest that the relationship between material sources and teaching effectiveness is more complex than previously understood. Rather than viewing different material sources as competing alternatives, the data indicates that they serve complementary functions in supporting teaching practice. This insight highlights the importance of both instructional material development and professional development programs that empower teachers to critically engage with and adapt materials to fit their teaching contexts.

## 5 Discussion

Our findings reveal a nuanced relationship between teaching materials, instructional design, and professional development. The
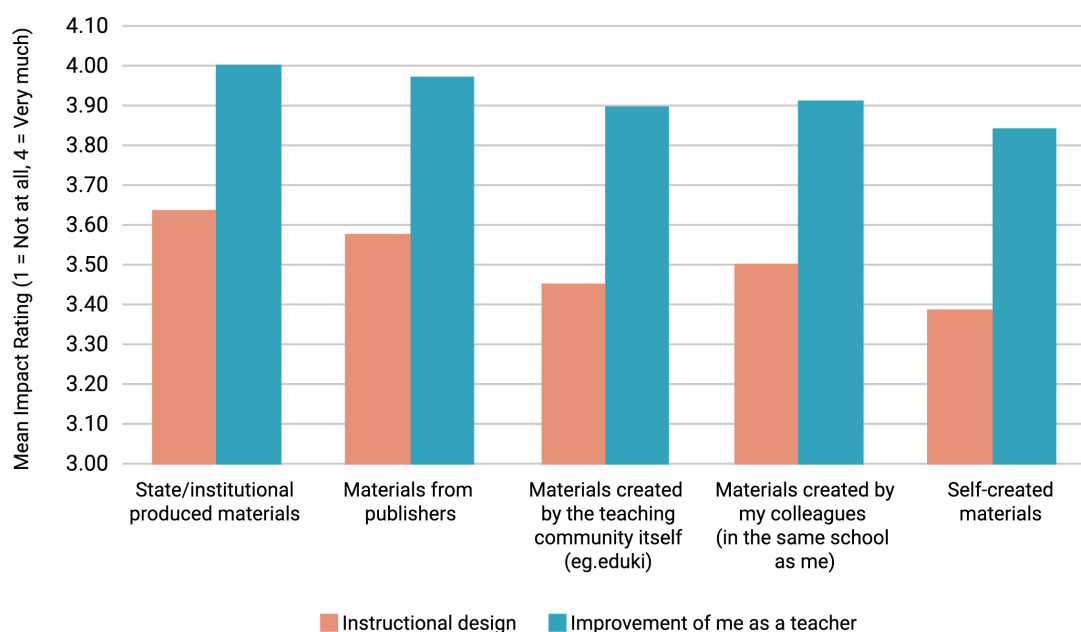


FIGURE 1
Usefulness of different teaching materials in boosting teacher confidence in the classroom.

decreasing impact of instructional design elements with experience suggests that as teachers gain expertise, they rely less on structured support for lesson planning. However, the sustained and even increasing impact on professional growth among very experienced teachers challenges conventional assumptions about career plateaus in teaching. This dual impact is further supported by the factor analysis, which identified "Instructional Effectiveness" and "Improves Me as a Teacher" as distinct but related factors. The high reliability of these factors ($\alpha = 0.81$ and $0.77$, respectively) provides a robust framework for understanding how teaching materials influence teachers throughout their careers.

A particularly striking finding is that very experienced teachers (10 + years) report the highest impact on professional growth (3.91) despite a slight decline in the instructional design impact (3.47). This challenges the notion that professional development stagnates over time and suggests that teaching materials serve as a vehicle for continuous learning, particularly when teachers have agency over their selection and adaptation.

## 5.1 Career stage differentiation

The contrasting patterns of impact for instructional design and professional growth across career stages provide crucial insights into teachers' evolving needs. The impact of instructional design is highest for trainees and decreases slightly as teachers become more experienced. However, professional growth remains consistently high and even increases for very experienced teachers.

This pattern suggests a shift in how materials are used over time. Early career teachers rely on materials for structuring lessons, defining concepts, and providing classroom guidance. Experienced teachers shift from heavy reliance on materials to selective adaptation, using them as tools for refining their instructional approaches. Very experienced teachers appear to engage with materials not for lesson planning, but as a means of ongoing self-improvement and reflection. This mirrors Hutchinson and Torres' (1994) view of materials as agents of change, supporting not only classroom delivery but also the evolution of teacher roles. These findings challenge traditional views of career plateaus in teaching, emphasizing that professional growth is not linear but continues to evolve over time. This aligns with a sociocultural view of teacher development, where tools such as teaching materials mediate professional growth and reflective practice (Vygotsky, 1978).

## 5.2 Teacher agency and material adaptation

The high levels of reported autonomy in material selection and adaptation indicate strong teacher agency. This aligns with Biesta and Tedder (2006)'s ecological understanding of agency, where teachers actively shape their professional environment rather than passively consuming materials.

A notable contradiction emerges in our findings. Teachers strongly prefer self-created and teacher-generated materials; however, they rate these materials more critically than publisher-produced resources. This paradox suggests that while autonomy is valued, it also comes with higher expectations. Graves (2019) argues that materials exist within a broader ecological system of teacher decision-making and identity formation, reinforcing our finding that professional expectations rise alongside autonomy. Teachers may be more critical of their own work and that of their colleagues because they evaluate it against higher professional standards. This supports Hargreaves and Fullan (2012)'s concept of professional capital, where teachers engage in self-reflection and peer critique as part of their professional identity.

Additionally, our findings indicate a shift in adaptation behaviors across career stages. Early-career teachers engage in exploratory adaptation, modifying materials frequently to fit their classroom needs. Experienced teachers exhibit selective refinement, making smaller, targeted modifications rather than completely restructuring resources. This shift from creative adaptation to strategic expertise suggests that material engagement changes as teachers develop greater pedagogical confidence.

## 5.3 Practical efficiency vs. pedagogical effectiveness

A key distinction in our findings is the difference between practical efficiency and pedagogical effectiveness. Many teachers prioritize materials that save time in lesson planning and classroom preparation and provide ready-to-use tasks that fit their curriculum needs. However, as teachers become more experienced, their focus shifts toward deeper pedagogical impact. Novice teachers benefit from materials that offer structure and predefined guidance. This aligns with Hattie's (2009) findings that effective resources can significantly influence learning when tightly connected to teaching goals. Experienced teachers may prioritize flexibility and conceptual depth over convenience.

This has important implications for professional development. Rather than just curating materials, training should emphasize how to critically assess and refine resources for greater learning impact. Platforms like *eduki* can support this transition by allowing teachers to engage in collaborative material refinement rather than mere content consumption.

## 5.4 Educational equity, material sharing, and cultural considerations

The strong preference for teacher-generated materials—particularly those shared on platforms like *eduki*—has significant implications for educational equity. These findings are echoed by Torphy et al. (2020), who highlight how online marketplaces foster teacher agency and promote access to diverse, peer-generated materials. As Darling-Hammond (2010) argues, equitable access to high-quality educational resources is essential for reducing disparities in student outcomes.

However, these findings must be interpreted within the specific context of the study. The findings may be particular to the one-platform used (*eduki*), and the sample consists exclusively of

*eduki* users, which may introduce bias toward valuing teacher-created resources. Future research should explore whether teachers outside of digital-sharing platforms exhibit similar preferences and levels of material adaptation. There may be important differences depending on the level of freedom to choose resources. For example, Austria, permits teachers greater flexibility in material selection, while Germany has more state-driven curricular guidelines, potentially leading to higher reliance on standardized resources. Future research could examine whether material reliance and adaptation practices differ across national educational policies.

## 5.5 Rethinking the role of publisher materials

While teacher-created materials are strongly preferred, this should not be interpreted as a dismissal of publisher-produced resources. Some teachers consider that publisher materials can be "inflicted upon them" without room for adaptation, and thus the issue may be not the quality of publisher materials but rather the lack of flexibility to modify them. Thus, teachers may benefit most from materials that are adaptable and allow for professional input. This aligns with the principle that "all education is local," emphasizing the need for resources that can be tailored to specific classroom contexts.

## 5.6 Policy implications

There are important policy implications based on the findings of this study. The study challenges the assumption that experienced teachers plateau in development, and thus policies need to support lifelong professional learning, recognizing that teaching materials can continue to enhance growth even after 10 + years of experience. While novices may benefit more from structured materials that help them build planning routines, align curriculum and assessment, and develop confidence in classroom delivery., more experienced teachers shift from reliance on materials to selective adaptation, demonstrating disciplined improvisation and a refined ability to align resources with student needs.

It is noted, as have many others, that teachers welcome flexibility in their choice of teaching material, and policies that enforce rigid top-down mandates are likely to be resisted, whereas policies may be more powerful oriented towards assisting teachers to optimally choose materials relating to the curriculum, the development needs of their students, and have the highest probability of efficiently and effectively lead to enhance student progress in their learning. The study also highlights the role of shared platforms like *eduki* in promoting educational equity by enabling access to high-quality, teacher-developed resources. This reinforces the need for investment in digital infrastructure for collaborative resource sharing and aligns with recent policy goals on equity and professional development through digital teaching tools (European Commission, 2020).

The study yields insights into what makes instructional materials effective and how they should be designed or shared.

Materials need to be designed for adaptability, for the expansion of peer-sharing platforms and collaborative authoring tools (teachers prefer and trust materials they or their peers have created), for access relative to the career stage (e.g., new teachers need more structured support, while more experienced teachers prefer tools for innovation and reflection). This calls for differentiated resource development aligned with career stages.

## 5.7 Limitations and future research directions

While this study provides valuable insights, several limitations must be acknowledged. Our sample is restricted to German-speaking teachers who use *eduki*. Thus, findings may not fully apply to teachers who rely on other platforms or traditional material sources. We note that one of the authors is an employee of *eduki* and future research could involve independent researchers to avoid any hint of bias; although it is noted that the second author has no relation to *eduki*. While the study highlights variations between Germany, Austria, and Switzerland, it may be that more comparative studies are needed to explore how state policies shape material selection. A major implication is that research is needed to track how teachers' interactions with materials evolve over time, particularly in relation to ongoing professional development. While this study included many curricula domains, more in-depth focus on specific subjects, or students with special needs could also be informative.

# 6 Conclusion

This study provides evidence for teaching materials' dual role in supporting instructional practice and professional development. The unexpected finding of increased professional growth impact among very experienced teachers challenges traditional assumptions about career development trajectories and suggests the need for more nuanced approaches to material design and professional development programming.

The findings have significant implications for educational policy, teacher education, and the design of teaching materials. They suggest a need for differentiated approaches to material design that cater to teachers at different career stages; integration of professional development elements into teaching material; support for teacher-led material creation and sharing platforms; and recognition of teaching materials as tools for ongoing professional learning. By employing the power of teaching materials as both instructional tools and vehicles for professional growth, we can better support teachers throughout their careers and ultimately enhance the quality of education for all students.

# Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

## Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the participants was not required to participate in this study in accordance with the national legislation and the institutional requirements.

## Author contributions

## Funding

## Acknowledgments

## Conflict of interest

LG is employed by Lehrerkolleg LK GmbH, the organization that funded this study.

The authors declare that this funding did not influence the study design, data analysis, interpretation, or reporting.

## Generative AI statement

The authors declare that Gen AI was used in the creation of this manuscript. Generative AI was used to assist with summarization, restructuring content, and formatting references. All research findings, analysis, and interpretations were conducted and verified by the authors.

## Publisher's note

## References

Apple, M. W., and Christian-Smith, L. K. (2017). The politics of the textbook. London: Routledge.

Ball, D. L., and Cohen, D. K. (1996). Reform by the book: what is—or might be—the role of curriculum materials in teacher learning and instructional reform? *Educ. Res.* 25, 6–8.

Berliner, D. C. (2004). Describing the behavior and documenting the accomplishments of expert teachers. *Bull. Sci. Technol. Soc.* 24, 200–212. doi: 10.1177/0270467604265535

Biesta, G., and Tedder, M. (2006). How is agency possible? Towards an ecological understanding of agency-as-achievement. *Learning Lives Research Report 5*. UK: University of Exeter.

Bouckaert, M. (2018). Current perspectives on teachers as materials developers: why, what, and how? *RELC J.* 49, 238–257.

Campbell, C. (2019). Pedagogical bricolage and teacher agency: towards a culture of creative professionalism. *Educ. Philos. Theory* 51, 31–40. doi: 10.1080/00131857.2017.1380842

Chan, K. K. H., and Yung, B. H. W. (2018). Developing pedagogical content knowledge for teaching a new topic: more than teaching experience and subject matter knowledge. *Res. Sci. Educ.* 48, 233–265. doi: 10.1007/s11165-016-9567-1

Cochran-Smith, M., and Lytle, S. L. (2009). Inquiry as stance: Practitioner research for the next generation. New York: Teachers College Press.

Darling-Hammond, L. (2010). The flat world and education: How America's commitment to equity will determine our future, vol. *91*. New York: Teachers College Press, 8–14.

Darling-Hammond, L. (2016). Research on teaching and teacher education and its influences on policy and practice. *Educ. Res.* 45, 83–91. doi: 10.3102/0013189X16639597

Darling-Hammond, L., and Bransford, J. (2005). Preparing teachers for a changing world: What teachers should learn and be able to do. San Francisco: Jossey-Bass.

European Commission (2020). Ethics for researchers: Facilitating research excellence in FP7. Luxembourg: Publications Office of the European Union.

Frank, K. A., Lo, Y., Torphy, K., and Kim, J. (2018). "Social networks and educational opportunity" in Handbook of the sociology of education in the 21st century. ed. B. Schneider (New York: Springer), 297–316.

Graves, K. (2019). Recent books on language materials development and analysis. *ELT J.* 73, 337–354.

Griffey, D. C., and Housner, L. D. (1991). Differences between experienced and inexperienced teachers' planning decisions, interactions, student engagement, and instructional climate. *Res. Q. Exerc. Sport* 62, 196–204. doi: 10.1080/02701367.1991.10608710

Guskey, T. R. (2002). Professional development and teacher change. *Teach. Teaching* 8, 381–391. doi: 10.1080/135406002100000512

Hargreaves, A., and Fullan, M. (2012). Professional capital: Transforming teaching in every school. New York: Teachers College Press.

Hatch, L., and Clark, S. K. (2021). A study of the instructional decisions and lesson planning strategies of highly effective rural elementary school teachers. *Teach. Teach. Educ.* 108:103505. doi: 10.1016/j.tate.2021.103505

Hattie, J. (2009). Visible learning: A synthesis of over 800 meta-analyses relating to achievement. London: Routledge.

Hattie, J. (2023). Visible learning: The sequel. London: Routledge.

Huberman, M. (1989). The professional life cycle of teachers. *Teach. Coll. Rec.* 91, 31–57. doi: 10.1177/016146818909100107

Hutchinson, T., and Torres, E. (1994). The textbook as agent of change. *ELT J.* 48, 315–328.

Knake, A., Novak, E., Blanchard, S., and Tesch, B. (2021). Digital curation in K-12 classrooms: Strategies for deeper learning. *TechTrends.* 65, 89–97. doi: 10.1007/s11528-020-00541-5

Krepf, M., and König, J. (2023). Structuring the lesson: an empirical investigation of pre-service teacher decision-making during the planning of a demonstration lesson. *J. Educ. Teach.* 49, 911–926. doi: 10.1080/02607476.2023.2196267

Lave, J., and Wenger, E. (1991). Situated learning: Legitimate peripheral participation. Cambridge: Cambridge University Press.

Mishra, P., and Koehler, M. J. (2006). Technological pedagogical content knowledge: a framework for teacher knowledge. *Teach. Coll. Rec.* 108, 1017–1054. doi: 10.1111/j.1467-9620.2006.00684.x

Priestley, M., Biesta, G., and Robinson, S. (2015). Teacher agency: An ecological approach. London: Bloomsbury Academic.

Roschelle, J., Pea, R., Hoadley, C., Gordin, D., and Means, B. (2010). Changing how and what children learn in school with computer-based technologies. *Futur. Child.* 10, 76–101. doi: 10.2307/1602690

Sahin-Taskin, C. (2017). Exploring pre-service teachers' perceptions of lesson planning in primary education. *Int. Electron. J. Elemen. Educ.* 9, 599–612. doi: 10.1007/s10639-017-9576-3

Sawyer, R. K. (2004). Creative teaching: collaborative discussion as disciplined improvisation. *Educ. Res.* 33, 12–20. doi: 10.3102/0013189X033002012

Shulman, L. S. (1987). Knowledge and teaching: foundations of the new reform. *Harv. Educ. Rev.* 57, 1–23.

Siemens, G., and Long, P. (2011). Penetrating the fog: analytics in learning and education. *Educ. Rev.* 46, 30–40. doi: 10.1080/08923647.2011.538646

Suartama, I. K., Yasa, I. N., and Triwahyuni, E. (2024). Instructional design models for pervasive learning environment: bridging formal and informal learning in collaborative social learning. *Educ. Sci.* 14:1405. doi: 10.3390/educsci14121405

Torphy, K., Liu, Y., Hu, S., and Chen, Z. (2020). Sources of professional support: patterns of teachers' curation of instructional resources in social media. *Am. J. Educ.* 127, 13–47. doi: 10.1086/711008

Vygotsky, L. S. (1978). Mind in society: The development of higher psychological processes. Cambridge, MA: Harvard University Press.