

Personalised and Differentiated Learning: a systematic literature review

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Abstract

Personalisation and differentiation are considered two inclusive approaches that acknowledge the differences among learners and aim to respond effectively to learners' broad array of learning needs. Extensive research and scientific literature have discussed the effects and benefits of both inclusive approaches in general education. However, less attention has been placed in examining the potential of personalised and differentiated learning in vocational education training and lifelong learning. Against this background, the present paper reports a systematic literature review to explore the current conceptualizations, empirical research, and professional development programmes in order to build a base for operationalizing personalisation and differentiation in vocational education training and lifelong learning. A total of 326 publications were considered eligible and were analysed against 22 research questions. Further research and implications of the results are also discussed.

Introduction

Our world today has become more and more diverse, and classrooms in every educational level mirror this reality. Elementary, middle, and secondary students as well as and postsecondary learners differ greatly in terms of performance, cultural background, language competence, gender-based learning preferences, learning styles, motivation, interest, self-regulatory competencies and other features (Dosch & Zidon, 2014; Hardy et al., 2019). Given the substantial and continuously increasing diversity of the learner population, teachers need to move away from the 'one-size-fits-all' model of teaching into inclusive instructional approaches that embrace learner diversity and provide meaningful education for all. In order to build inclusive classrooms, educators need to create effective learning environments that provide equal learning opportunities for all learners (Gheysens, Consegra, Engels, & Struyven, 2020). Personalisation and differentiation are rooted within inclusive education philosophy that argues that diversity is to be found in any group of learners, and therefore,

educators should adjust their instruction accordingly (Lindner, Alnahdi, Wahl, & Schwab, 2019). The same holds true for adult education. Huddleston and Unwin (2014) argue that learners across postsecondary education do not only differ in terms of ability, prior experience or motivation, but also their expectations, social class, cultural backgrounds and their domestic circumstances may be widely different. To this regard, the authors further describe that some of the learners may be returning to learn after a long break, or may be continuing their education in a different environment, or maybe will be attempting to combine-full time employment with part-time study and family requirements.

Research relating to elementary, middle, and secondary students has documented the positive effects of personalisation and differentiation (Bal, 2016; Chamberlin & Powers, 2010). For instance, Valiandes (2015) found that differentiation positively influenced student achievement. On the other hand, teachers' use of personalised and differentiated instruction has also shown to foster students' motivation and self-confidence (McQuarrie and McRae, 2010). In comparison to research into the effects of personalisation and differentiation within general education, scientific literature and empirical studies in postsecondary, vocational education training, and lifelong learning settings have gained less attention. However, there are some indications of positive effects of such inclusive practices in postsecondary education (Tulbure, 2011). Moreover, scientific literature has discussed valuable insights into the importance of considering diversity in vocational and higher education as it has shown that diversity is not limited to students' background characteristics, but as well to the variability in the features of the learning environment (Jansen, Suhre, & André, 2017). Thus, within cooperative education, such as the case of vocational education training or lifelong learning, the learner is placed in a central role when considering the curriculum, educational provisions and pedagogy in terms of place and setting (Billet, 2006). In doing so, there is an emphasis on how learners make meaning, construe, and construct learning from their experience as well as how learners elect to engage with what is afforded to them. In this context, the demand to

create educational spaces that encourage stimulating teaching and learning processes for all students and learners across different educational levels and settings is only increasing (Linder & Schwab, 2020).

Against this background, the present assignment attempts to provide an in-depth exploration into the concepts of personalisation and differentiation and their implications within secondary and postsecondary cooperative education settings as well as adult learning.

Aim of the literature review

This study stemming from the initiative Creating New Learning of the ETF has the primary aim to identify solutions that could be implemented to foster innovation in vocational teaching and learning across different national contexts. Hence, scientific literature dating from 2010 has been reviewed to examine the relevance and application of personalisation and differentiation to the domains of general education as well as postsecondary education such as vocational education training and lifelong learning across formal, non-formal and informal settings. The review is guided by the following main research objectives and questions:

I. Theoretical frameworks and current approaches

- a) What is personalised and differentiated education?
- b) What is a personalised approach to life-long, 21st century skills development?
- c) How do personalisation and differentiation relate to changes in current or future skills needs (e.g. key competences) and to current or future changes in the needs of learners (e.g. lifelong learning, inclusive learning) as well as support transition into vocational education training?

II. Differentiation in action: practices and assessment

- a) What are the range of practices that constitute personalisation or differentiation?

- b) What tools and materials are available to support greater personalisation?
- c) How can personalisation and differentiation be introduced or expanded in different learning environments – such as classrooms, training centres and workplaces and open learning (and also in blended learning, such as through alternance and apprenticeship)?
- d) What kinds of curriculum and curriculum materials support personalisation and differentiation? E.g. discretion to providers to design curriculum, minimal competence standards or frameworks.
- e) What kinds of assessment (formative and summative) methods and tools support personalisation and differentiation, in particular with respect to vocational learning?

III. Effectiveness and benefits

- a) Which is the impact of personalisation and differentiation on achievement and non-achievement outcomes?
- b) Are there specific aptitude-interaction-effects derived from these practices? What are the potential results/effects on the different student groups?
- c) What are the short term and long-term benefits of personalisation and differentiation?
- d) Which of these are most relevant to developing and middle-income countries, for example, economies in East and South Eastern Europe, the Eastern Mediterranean, North Africa and Central Asia?
- e) What are the particular benefits of personalised learning in relation to trends in skills demand and the extension of lifelong and inclusive learning?
- f) Are there benefits from personalised learning which are result from connecting learning experiences in different environments, in particular, between work- based and other learning or by increasing coherence between different learning episodes?

g) How can the benefits of personalisation and differentiation be optimised and sustained?

IV. Barriers and enablers

a) How are personalisation and differentiation supported or inhibited by preconditions or actions at the level of institutions and systems?

b) How do barriers to personalisation and differentiation (e.g. cost, complexity), enablers (e.g. professional networks) and drivers (e.g. new curriculum) differ for different learning environments, different kinds of organisation and different education systems and different levels within systems, e.g. institutional, local, and national?

V. Implications for educators and their professional development

a) What are the implications of the above for educators (teachers, trainers, educational managers)

b) Which educators' characteristics (e.g. preparedness, teacher beliefs, mindset, self-efficacy, and attitudes) have an effect on their implementation of personalisation and differentiation?

c) What are teachers' hindrances, concerns and challenges in relation to implementing personalisation and differentiation?

d) What are the theoretical and practical approaches within the topic of personalisation and differentiation to build professional development courses for educators?

e) What role can coaching and mentoring have on personalisation and differentiation within a work-based learning environment?

Method

The systematic literature review was designed and conducted following Xiao and Watson (2019) guidelines. The systematic literature review was conducted in four stages: (1) development of research protocol, (2) literature search through systematic one-by-one database searches, (3) screening process, and (4) study analysis and synthesis of outcomes.

Research protocol

Inclusion criteria

A publication had to meet the following criteria to be considered appropriate for the systematic review:

- Date of publication: the literature review will be focused on identifying articles that were published from 2010 until 2020.
- Language of publication: the literature review will be limited to English, Spanish and German language articles.
- Sample: the specification of the desired sample is limited to secondary education as well as postsecondary education including vocational education training and lifelong learning.
- Type of publication: qualitative and quantitative research studies, project reports, feedback surveys, impact studies, evaluation reports, etc.
- Personalisation and/or differentiation: the publication must assess concrete features of personalised and/or differentiated learning.

Search strategies

For the purpose of the systematic literature review, the following search strategies were implemented.

- Three major sources to find literature were used: First, electronic databases such as ERIC, PSYINDEX, and Education Research Portal, but as well Google Scholar were used. Norris, Oppenheim, and Rowland (2008) compared Google Scholar to other literature databases and found that it outperformed any other search engine. Additionally, Google Scholar is a very powerful open access database that is able to obtain further types of literature such as “grey” literature, conference proceedings, thesis, and reports (Xiao and Watson, 2019). Second, a backward search to identify relevant work cited by the articles obtained was conducted. Third, a forward search was performed in order to find all articles that have since cited the articles reviewed.
- Keyword trail search: a search trail with the keywords defined in the previous section and specific combinations of them were conducted to adjust the search. Furthermore, as suggested by Fink (2005), search strings such as “AND” and “OR” were used to refine the search. Using Boolean operators in the search allows to join the main terms and to include synonyms (Breretona, Kitchenhama, Budgenb, & Khalilc, 2007). Kitchenham and Charters (2007) suggest that in order to revise whether the keywords and the search strings were working, trail searches should be compared to previous search lists of already known primary studies. In this line, the trail searches were compared to a previous search of literature conducted and already published (see Pozas & Schneider, 2019). The search strings used in this review were:

Table 1. Categorization of search strings.

Language	Search string
English	(1) “inclusive education” OR “personalised instruction” OR “differentiated instruction” OR “adaptive teaching” + “vocational education training”

	<p>(2) “diversity” + “personalised instruction” OR “differentiated instruction” OR “adaptive teaching” + “vocational education training”</p> <p>(3) “personalised instruction” OR “differentiated practices” + “vocational education training”</p> <p>(4) “flexible grouping” OR “differentiated practices” + “vocational education training”</p> <p>(5) “inclusive education” OR “personalised instruction” OR “differentiated instruction” OR “adaptive teaching”</p> <p>(6) “diversity” + “personalised instruction” OR “differentiated instruction” OR “adaptive teaching”</p> <p>(7) “personalised learning” OR “differentiated instruction”</p>
Spanish	<p>(1) “educación inclusiva” OR “educación personalizada” OR “educación diferenciada” OR “enseñanza adaptativa”</p> <p>(2) “diversidad” + OR “educación personalizada” OR “educación diferenciada” OR “enseñanza adaptativa”</p> <p>(3) “educación personalizada” OR “educación diferenciada”</p>
German	<p>(1) “Inklusion” OR “Personalisierung” OR “Binnendifferenzierung” OR “Individualisierung” OR “Adaptives Lernen”</p> <p>(2) “Heterogenität” OR “Personalisierung” OR “Binnendifferenzierung” OR “Individualisierung” OR “Adaptives Lernen”</p> <p>(3) “Personalisierung” OR “Binnendifferenzierung” OR “Individualisierung” OR “Adaptives Lernen”</p>

- Stopping rule: Following the rule of thumb by Levy and Ellis (2006), the search was stopped when repeated searches result in the same references with no new results.

Screening procedure

Following guidelines by Breretona et al. (2007), literature was screened based on their titles and abstracts. When the abstracts did not provide enough information, the conclusions section was also read. After the first screening stage, a second full-text assessment of the records was conducted. Finally, publications that did not offer guidance into the topic of the literature review were excluded of the analysis.

Literature search and data extraction

The literature search was divided into three stages. Firstly, a systematic database screening was conducted. The screened databases were ERIC, PSYINDEX, Education Research Portal, and Google Scholar. Through this process, key search strings were limited to the combination of the keyword “vocational education training”. The total number of articles assessed for eligibility through the database search was 35. Secondly, further records were identified through a backward and forward search, as well as other records identified for the inception report were revised again. The amount of records identified for eligibility in the second stage totalled 125. Finally, following feedback from the ETF team, a third literature search was developed and conducted. As in the previous literature, research electronic databases such ERIC, PSYINDEX, Education Research Portal, and Google Scholar were used. In line with the feedback provided by the ETF project leader, this review opened the scope of the research and further included literature written in Spanish and/or German (see table 1). When using such search strings, the total amount of hits were the following: (a) 17,000 hits for “inclusive education” OR “personalised instruction” OR “differentiated instruction” OR “adaptive teaching”, (b) 16,700 hits for “diversity” + “personalised instruction” OR “differentiated instruction” OR “adaptive teaching”, (c) 17,700 hits for “personalised instruction” OR “differentiated instruction”, (d) 397,000 hits for “personalised instruction”, and (e) 117,000 hits for “differentiated instruction”. Therefore, in order to make the search more efficient, certain exclusion criteria was considered:

- All literature referring to kindergarten or primary school education was excluded.
- Most literature concerning personalised learning was tightly linked to digital e-learning approaches. Therefore, only noteworthy studies were included in the research.

From the extensive amount of research, noteworthy studies, as well as the articles with notable authors in the field were identified for screening. A total of 208 research articles (with different methodological approaches), country reports, praxis books, and doctoral

dissertations were obtained. From this total amount of literature, a second screening was conducted with a total of 196 records have been incorporated. The final amount of records obtained from the three stages totalled 326 publications. These records were categorized according to the literature review's research objective.

Table 2. Total amount of records categorized according to research objective

Research objective	Number of records
Theoretical frameworks and current approaches	67
Differentiation in action: practices and assessment	106
Effectiveness and benefits	41
Barriers and enablers	41
Implications for educators and their professional development	71
Total	326

Results

In total, 326 publications were considered eligible and were analysed against the background of the research objectives. Important to highlight is that from this total amount of publications, 50 records were selected and identified as the core literature in the domain. These publications have been categorized in a table for easier identification (see Table 1). Across the selected studies, the characteristics and specifications vary significantly. The geographical placement of the publications covers Europe, North America, and Asia. The research methodology included qualitative and quantitative approaches were interviews, questionnaires, meta-analysis, and document analyses were followed. The extracted studies highlighted the perspectives of general education teachers, students, principals, coordinators, and educational managers. The educational settings included a focus on secondary education, comprehensive education, higher education, and vocational training.

By extracting outcome information about personalisation and differentiation within each publication, commonalities were identified based on key passages in the text and summarised in thematically overarching categories. In order to illustrate the results of the

systematic literature review the research objectives are presented separately. Additionally, specific sections addressing each research question within the specific objectives are also included.

Theoretical frameworks and current approaches

Operationalizing Personalisation and Differentiation in the classroom

The personalised and differentiated design of teaching and learning process is a didactic approach that attempts to ensure educational justice and fairness (OECD, 2012, 2018). Both personalisation and differentiation have their didactic starting point in the needs of the students (Dixon, Yssel, McConnell, & Hardin, 2014; Linder, Alnahdi, Wahl, & Schwab, 2019; Prain et al., 2013; Tomlinson, 2017). Personalisation, or also known as individualisation (e.g. Linder et al., 2019; Prain et al., 2013), addresses students individual educational needs on a micro level. According to Patrick, Kennedy, & Powell (2013), personalised learning means tailoring learning for each individual learners' interest and needs. Jones et al. (2013) proposed three key aspects to personalised learning: choice, personal relevance, and learner responsibility. Prain et al. (2013) argue that personalising responsibility for learning is a basic developmental need; therefore, it requires a range of teacher and learner strategies, experiences, and understandings that eventually lead to a student's capacity to co-design their curriculum with their teachers. From this perspective, content, material, support, assessment, etc. can be personalised for students when there is a productive interplay between teacher expertise in identifying and addressing students' ongoing individual needs, and student capacity to develop increasing independence as learners (Linder et al., 2019; Prain et al., 2013; Waldrip, Yu, & Prain, 2016). Overall, personalisation encourages flexibility to support mastery and provides students the opportunity to influence how, what, when, and where they learn (Basham, Hall, Carter, Stahl, 2016).

Differentiation refers to a pro-active, reactive, and deliberate adaptation of the content, process, product and learning environment based on the assessment of students' readiness or another relevant student characteristic such as interest or readiness (Smale-Jacobse, Meijer, Helms-Lorenz; Maulana, 2019; Tomlinson, 2017). Content here refers to the knowledge, understanding, and skills that students need to learn. Process means the activities of teaching and learning, here tailored to learners' needs (e.g. establishing different groups, allowing students to work at different speed, provide supports). Product refers to the interim or final outcomes of learning, that is the competences that are acquired through teaching and learning – which may be assessed formatively or summatively. By learning environment is meant the situation or ecology of teaching learning, which may entail a distinctive configuration of process/content and product, such as in a classroom or in the workplace or a university.

The concept of adaptive teaching is focus for research within the field of teaching and learning research in educational psychology. Much like differentiation and personalisation, it focusses on the optimization of learning process and its core objective is to identify practices that teachers use to teach all students (Corno, 2008, pg. 162). While adaptive teaching, differentiation, and personalisation may differ in underlying theoretical assumptions, terminology, and instructional arrangements, these concepts are all dedicated to effectively address student heterogeneity. Dumont' review of research (2018) conceptualises adaptive teaching is an overarching pedagogical approach implicitly subordinated to a wider conceptualization of inclusive pedagogy.

Differentiation is usually regarded as an attempt to respond to the *group-specific* needs of students within a class (Lindner & Schwab, 2020). This means that the learning goals are the same for all students, but the path to achieving them is modified and offers different possibilities (Smale-Jacobse et al., 2019). Thus, differentiation, in contrast to personalisation,

can be said to an adapted teaching practice that characterises the teaching of multiple diverse groups as opposed to individual learners..

Personalisation and differentiation as a means to address all learners' needs

The need for personalisation and differentiation has resulted from a number of developments in education. First, given the current policies focused on detracking schools, inclusion of students from diverse backgrounds, and inclusive education in which special education students (SEN) attend classes with non-SEN students (Tomlinson, 2015). Second, even within relatively homogeneous classrooms, there are still considerable differences between students. Thus, the fact that all learners have different learning needs inherently challenges the idea of a one-size-fits-all approach. In this line, policymakers and researchers stress that all students should be supported to develop their knowledge and skills at their own level in order to improve equality among students (Schleicher, 2016; UNESCO, 2017). From a combined sociocultural, psychological, and economic perspective, personalisation and differentiation are an appropriate solution to the challenge of motivation and supporting students, and can lead to both personal and national economic benefits (Prain et al., 2013). When learning is being successfully personalised or differentiated, students are engaged in learning, show responsibility, control, and choice over their learning and behaviour, and demonstrated as well maturity in relating to their peers and school staff (Danley & Williams, 2020).

Framing Personalisation and Differentiation in vocational education training and lifelong learning settings

The principal purpose of vocational education training and lifelong learning has been to support and maintain an individuals' workplace competence (OECD, 1996). However, in today's world, globalisation, technological progress, and demographics have had a profound impact on the world of work. As a result, there is a call to provide individuals "with the opportunities to upskill and/or reskill throughout their working lives" (OECD, 2017, p. 12). Furthermore, with changes in society, population flows, and the world of work, there is also an increasingly diverse population of learners in the workforce. As a consequence, today's work-based, adult, and further life-long learning settings must not only address current and future skills needs, but also be differentiated in relation to diverse learner experiences, histories and needs. In short, as adult and continuing learning grow in importance, for those in and out of work, personalised and differentiated learning approaches will become even more relevant and urgent (Billet, 2006). However, there is a need to bring together research into personalised/differentiated learning, on the one hand, with research into work-based and lifelong learning, on the other, in order to understand the particular configuration and form of personalised/differentiated learning in these environments.

Up to now, most scientific literature and research regarding personalisation and differentiation has been grounded within the field of general education. However, less has been done to analyse and explore whether these assumptions can also be broadened into other educational settings such as postsecondary education, vocational education training, lifelong learning. Even the present literature review can corroborate this fact as only 24% (78 records) of all records identified discussed postsecondary, vocational education, and lifelong learning learners. In this line, and based on the examination of the literature, a theoretical model has been designed for the purpose of vocational education training and lifelong learning settings. In Figure 1, a proposal of a theoretical framework of personalisation and differentiation within vocational education training and lifelong learning is presented. This model has been built based on the current literature on personalisation and differentiation. In consequence,

this model neglects important features of vocational educational training and and lifelong learning. Nonetheless, this first attempt to frame personalisation and differentiation in postsecondary education settings opens the door for researchers and practitioners to initiate discussions into this field and hopefully, as a result, revise the validity of the model within vocational education training and lifelong learning.

Personalisation and differentiation in the vocational education training and work-based learning context entails first, for teachers to embrace and acknowledge learners' differences and own experiences. Teachers must reflect on the classroom heterogeneity and establish the learning goals. Teachers must as well reflect upon the learning environment or context in which they will set and implement their personalised and differentiated lesson in order to use the setting and resources effectively and meaningfully. Second, teachers must carefully select the practices (for a detailed description on personalised and differentiated practices and techniques please refer to the section 'differentiation in action') they want to be personalised or differentiated. Based on their reflections on student heterogeneity, learning goals, and learning environment, they should offer learners' adapted content, provide various options in the learning process, or use different assessment products (Tomlinson, 2014). Huddleston and Unwin (2013) discuss that teaching and learning across in postsecondary education necessitates teaching styles that are learner-centred, flexible, and emphasized learners' experiences. In this vein, the implementation of personalised and differentiated instruction can quite possibly enhance a learner's experience and learning process.

Given that the successful implementation of personalisation and differentiation depends greatly on other crucial steps, the model has also included and embedded other important teacher behaviours. High quality differentiated instruction is based on the continuous monitoring and use of formative assessment of pupil learning needs (Smale-Jacobse et al., 2019). Additionally, teachers must also thoroughly evaluate whether the

personalised or differentiated practice was effective and learners were able to achieve the learning goals. This helps teachers to make adjustments (if that is the case) to their personalised or differentiated lesson and change those issues that were not successful.

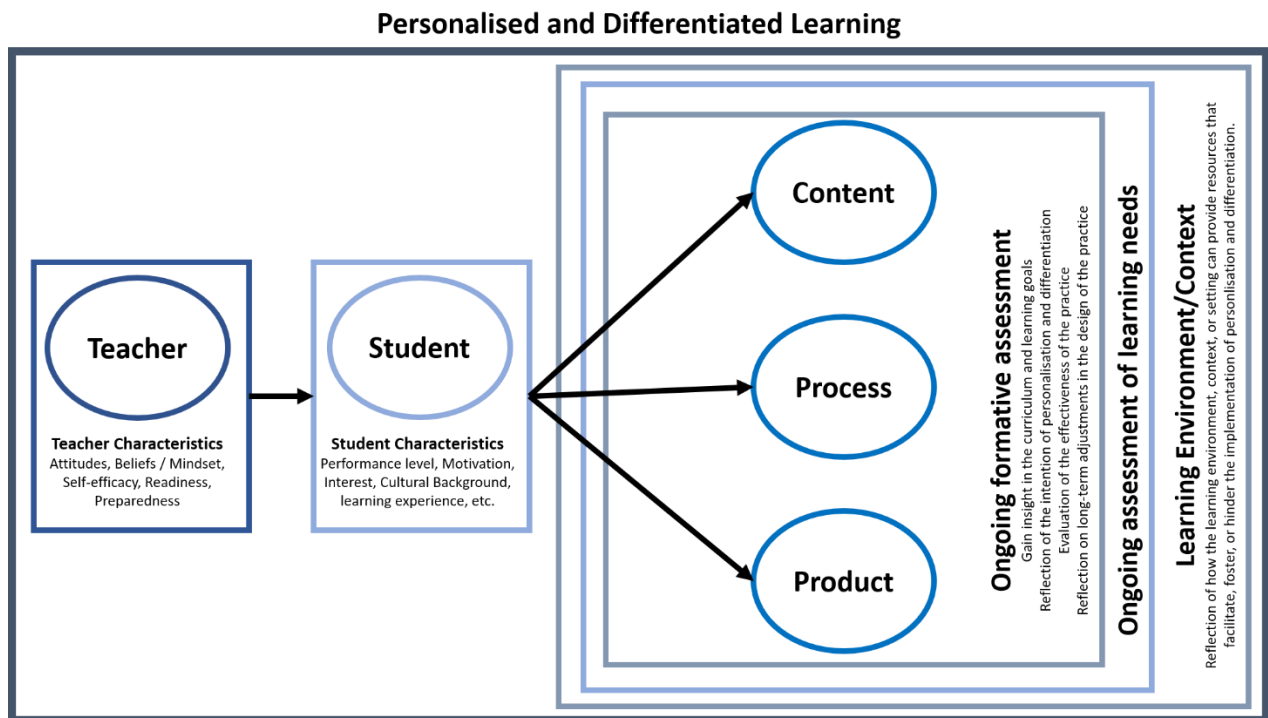


Figure 1. Theoretical Model of personalised and differentiated learning in vocational education training and lifelong learning settings.

Differentiation in action: practices and assessment

Personalised and differentiated practices

The analysis of publications focusing on personalised and differentiated practices discuss that in order to maximise learning, teachers should modify the content, processes, and products according to their students' readiness, interests, and learning profiles. In doing so, teachers seek to implement the most appropriate instructional activities directed at effectively meeting students' diverse learning needs while continuously monitoring students' academic process (Dack, 2019; Suprayogi et al., 2017). The ways in which teachers can address

students' learning needs by means of personalisation and differentiation are (Lindner et al., 2019; Lindner & Schwab, 2020; Pozas & Schneider, 2019; Smale-Jacobse et al., 2019; Tomlinson, 2017):

1. *Tiered assignments*: Tiered assignments are the most applied inclusive practice. They focus on a specific learning goal, topic, or concept and provide different instructional alternatives for students to achieve understanding and address learners' preferences, learning profiles, and/ or motivation (Pozas & Schneider, 2019). Tiered assignments to be any differentiating practice that includes variations of materials, worksheets, and tasks (Leuders & Prediger, 2016). This conceptualization allows tiered activities to be adapted and varied in terms of quantity (amount of tasks and/or time available) and/or quality (varying the complexity) (Prast, van de Weijer-Bergsma, Kroesbergena, & Van Luit, 2015). Tiered assignments guide students towards different ways of processing information. They allow low-achieving students to engage in meaningful learning, increase their academic achievement, and provide high-achieving students with the opportunity to expand and deepen their knowledge as well as to transfer their understanding to other contents (Richard & Omdal, 2007; Tomlinson, 2001).
The use of tiered assignments does not necessarily imply that the teacher assigns the tiered tasks to different students or groups (a method that empowers the teacher as the manager of learning). Students can also freely select the tasks they want to work on (a more constructivist strategy). Both approaches may have their advantages and disadvantages. The teacher-allocation method might have a detrimental outcome if, for example, a teacher does not assign tasks based on the students' needs. In contrast, student choice would fail if the students themselves are unable or unwilling to select tasks that correspond to their real ability level (e.g. when too simple tasks are chosen in order to avoid effort).

2. *Homogeneous or heterogeneous grouping*: Homogeneous and heterogeneous grouping are two types of intentional grouping commonly used as differentiation and individualisation practices (Misset, Brunner, Callahan, Moon, & Azano, 2014) as the teacher is able to cater to the needs of these groups by implementing different DI practices. For the case of homogeneous clustering, teachers group students based on a common characteristic such as ability or interest (Smale-Jacobse et al., 2019). From the teacher's point of view, homogeneous ability grouping often implicitly or explicitly pursues the goal of devoting particular attention to the weaker groups and supporting them individually, while the stronger groups work autonomously on specific demanding tasks (Pozas & Schneider, 2019). Additionally, homogenous groups with different levels of academic readiness naturally call for the provision of tiered assignments, as teachers need to adapt the instruction and strategies to students (or to the group of students) to the different learning needs and ability levels. Alternatively, teachers could use heterogeneous grouping. In this context, differentiation occurs because students divide tasks within the group based on their learning preferences or abilities (Smale-Jacobse et al., 2019). Heterogeneous grouping commonly implies that helper or tutoring systems are formed within the groups.
3. *Tutoring systems*: a key differentiated and personalised strategy is the practice of establishing tutoring systems ("learning by teaching" or peer tutoring). Peer tutoring refers to an instructional setting in which high-ability students adopt the role of teacher assistants and tutor lower-ability students. The goal is that the tutees benefit from receiving individualized additional instruction, while the tutors may benefit from explaining and teaching the learning content in their own words and from becoming responsible for the learning processes (Pozas & Schneider, 2019).
4. *Staggered nonverbal learning aids*: Nonverbal learning aids are a carefully and purposely designed series of learning aids that which may range from a simple

explanation serving as a learning cue, to a more complex clarification or representation of a procedure used to solve the task at hand. An optimum use of staggered nonverbal learning aids is only feasible if they are used following a “minimally invasive” principle (Becker, 2008): including the minimal information necessary for a student to overcome a difficulty. Providing too much information or support may be counterproductive as it might lower students’ efforts.

5. *Mastery learning*: The principle of mastery learning has been considered as a powerful DI practice in the literature and research (Guskey, 2010; Tomlinson & Imbeau, 2010). Within the mastery learning approach, the first step is to reduce the subject matter or curriculum. This technique is labelled curriculum compacting (Reis, Burns, & Renzulli, 1992) and consists first on defining the standard levels: (1) Minimal standards, the baseline level every student (regardless of ability level) must achieve; (2) norm/ intermediate standards, the average level of performance to be achieved, and (3) maximum standards, the highest level of performance that can be expected or achieved. Once these standard levels are defined, teachers then determine the information most students will understand, develop corresponding learning activities, and establish learning goals corresponding to these standard levels (Niggli, 2013). The practice of mastery learning involves close monitoring of students’ learning progress. Niggli (2013) proposed cooperative mastery learning design options such as group tournaments or competitions in which, instead of the students’ individual achievements, the overall group result is assessed and graded. For the case of vocational education, Darnon, Buchs, & Desbar (2012) suggest the use of the jigsaw method in classroom. Following this technique, the academic material is subdivided into different pieces of information, each is crucial for the understanding of the entire content. This method comprises three aspects: first groups of five or six learners are formed. Each learner is assigned a part of the material on which they are expected to

become an “expert”. In order to achieve this, learners are given the opportunity to discuss their areas of expertise with other learners not in their original group, but who have worked on the same part of the material. Finally, each learner presents a report of what he or she has learned about his or her own topic to the rest of the learners’ original group. The jigsaw technique involves positive goal interdependence and individual accountability.

6. *Open education / granting autonomy to students*: With respect to DI, open education assumes that when learners are granted the autonomy to individually select their tasks and assignments, they would naturally turn to the tasks that best suit them. In this vein, an open education approach is learner-centred where teachers act as facilitators working alongside students while providing a wide range of activities and materials. Open education fosters learners’ autonomy, choice, and responsibility for their learning (Pozas & Schneider, 2019). An open education practice that has been investigated suggested by scientific literature relating to vocational education is the use of problem-based learning. Problem-based learning provides a basis for developing work-related skills because learners typically work together in groups, conduct research, and integrate theory and practice (Sada, Mohd, Adnan, & Audu, 2015). Through problem-based learning, learners are engaged in real-life problem-solving tasks. Hence, this practice has been considered a student-centred approach engaging participants in complex problems with open-ended answers (Jabarullah & Hussain, 2018). If learning is structured around an authentic problem, then the content, the process and the results of learning, will all be shaped by that problem rather than, for example, subject content. The impact that problem-based learning has on learners’ performance can be attributed to its relation to learners’ learning styles. Problem-based learning is an instructional approach that is personalised and differentiated in so far as it permits learners to shape their learning in a way that adapts it to their needs,

motivation and objectives. However, not all authentic problems do facilitate learning which is personalised and differentiated in this way – some workplaces do not facilitate personalised and differentiate learning..

Personalisation and differentiation across different learning environments

Scientific and empirical literature into personalised and differentiated learning environments have mostly centred around general education. Nonetheless, personalising and differentiating instruction is a highly flexible and responsive procedure (Valiande & Tarman, 2011). Findings from this literature do help us to understand how personalisation and differentiation might be embedded into work-based learning settings. Tomlinson and Imbeau (2010) argue that personalisation and differentiation require four interdependent elements: curriculum, instruction, assessment, and learning environment. According to Tomlinson and Imbeau, the learning environment should be shaped and adapted to provide the opportunity for all to maximize their learning capacities. In the context of work-based and life-long learning, the approach might be to select appropriate ‘given’ environments rather than to ‘create’ artificial learning environments. Tomlinson and Imbeau (2010) argue that in order to establish a successful personalised and differentiated learning environment, teachers must know their students (their readiness, learning profile, interests, motivation), build a community, and provide a suitable physical environment. By building a community, teachers offer the opportunity to craft a common vision in which everybody is included and where all individuals are committed to support one another in learning. In the context of work-based learning, this would imply that the organisation supports the development of a ‘learning culture’, that it becomes a ‘learning organisation’ whose workers have access to those experiences, colleagues and resources that favour their learning. Evidently, this is a

demanding and potentially costly process, which may, nevertheless, have great benefits for the organization (Critten, 2016).

Tools, materials, and formative assessment that support greater in-class personalisation and differentiation

As discussed by Van Geel et al. (2019) and Smale-Jacobse et al. (2019), personalisation and differentiation are not only reduced to the actual in-class implementation, but it encompasses several crucial steps in order to ensure success of both practices. Teacher behaviours related to personalisation and differentiation include continuous monitoring and, in particular, formative assessment (Tomlinson, 2017). Information collected within formative assessments may then be used to decide how to personalise and differentiate based on students' learning pace, knowledge and understanding, and interest as well as to plan the content, process, and product. Prior to the lesson including personalisation and differentiation, teachers must clarify learning objectives and use some form of pre-assessment (Prast et al., 2015). Learning objectives must be customized so that students are adequately challenged and encouraged to use their background knowledge. After the lesson, teachers should evaluate their students' progress towards the learning objectives previously established (Smale-Jacobse et al., 2019).

Cha and Ahn (2014) identify five elements of tools to support teachers and to facilitate their personalisation and differentiation practice. First, teachers must analyse their student characteristics and needs from an early stage. Second, teachers must plan a prescriptive instructional design based on the evaluation of learners, including their goals, resources, and strategies. Third, creating a management system that assists teachers in handling student data. Fourth, ongoing revision in terms of student interests as well as evaluation of achievements in order to provide constant feedback. Fifth, teachers should collaborate and share with one

another. Peer coaching can also encourage teachers to improve their inclusive practices.

Although these five elements are key features to support personalisation and differentiation, it is important to highlight that they all require a great deal of time and effort. However, recent research points out to teacher collaboration as been an essential support for teachers' overall planning, designing, implementing, and evaluating of personalised and differentiated instruction (Gheysens et al., 2020). Therefore, teacher collaboration could be considered as a buffer to the demands of personalisation and differentiation.

Curriculum and curriculum materials to support personalisation and differentiation

Billet (2006) proposes an 'experienced curriculum' that integrates the learning objectives with a particular and personal learning environment. This means that the curriculum considers what learners experience and as such is focused on guiding and enriching the experiences of learners across these settings. This experienced curriculum inherently guides teachers to personalise tasks that considers learners' prior experiences and learning goals. Important to highlight is that practices such as awareness and self-reflection can support an experienced curriculum as they allow for learners to conduct an in-depth analysis of their learning process and experiences.

Effectiveness and benefits

Personalisation and differentiation: effectiveness and benefits from primary education to vocational education training, lifelong learning, and post-secondary education

Throughout the literature analysis, it was possible to identify the positive effects of personalisation and differentiation across educational settings where both approaches have been implemented. Reviews of effectiveness of personalisation indicate small effects on

student achievement (Hattie, 2009). Hess and Lipowsky (2017) suggest that the low effectiveness of personalisation may be due to the fact that teachers who implement such practice tend to focus more on organising personalised instruction rather than the quality of the content they teach. However, evidence from a recent research report from the Bill & Melinda Gates Foundation and carried out by Pane, Steiner, Baird, & Hamilton (2015), suggests that the effects of personalised learning on student achievement are promising. In detail, findings indicate that the majority of schools adopting a personalised approach had positive effects on student mathematics and reading performance over two years. In another study by Basham et al. (2016), qualitative data obtained from an 18-month descriptive research showed that learners' self-regulation was developed and consistently used throughout the personalised learning environments. Additionally, learners became active participants, assuming responsibility for their learning. With relation to specific personalised practices, administrators and teachers identified project-based learning approaches as an important way of providing learners with choice and with a personalised path through content. A study by Darnon et al. (2012), where vocational education learners were examined before and after using the cooperative jigsaw technique, demonstrated that learners participating in significantly improved their self-efficacy. A more recent study conducted by Han & Ellis (2020), where 365 undergraduates from an Australian university followed a personalised learning approach, indicated that higher education learners performed better in learning the contents of the subject matter, but also developed their collaborative skills.

For the case of differentiation, large-scale studies have shown the efficacy of an inclusive approach. Goddard, Goddard, and Minjung (2015) examined students' mathematics and reading achievement when instructed in schools that followed a differentiated approach. In contrast with schools that did not employ differentiated practices, treatment schools reported a positive and significant difference in student achievement for both subjects. A study by Valiandes in Cyprus (2015) yielded similar results, with the use of differentiated

practices in mixed-ability classrooms producing positive effects on student achievement. In Turkey, Bal's (2016) study reported that student achievement in algebra was correlated with teachers' implementation of differentiation. Positive effects of differentiation have also been reported for outcomes other than achievement such as students' learning interest and self-confidence (Eysink et al., 2017; McQuarrie & McRae, 2010). Huddleston and Unwin (2014) discuss postsecondary education grouping practices, such as heterogeneous groups, and tutoring systems could support learners who lack confidence and to gain extra motivation and encouragement by working with other students.

A number of studies and reviews have reported on the effects and benefits of the specific differentiated practices on student and learners' performance and ability. One of the most frequently examined practices is homogeneous and heterogeneous ability grouping (Smale-Jacobse et al., 2019). In Steenbergen-Hu et al.'s (2016) meta-synthesis, ability grouping was found to have a small positive impact on students' academic achievement. Older meta-analyses have found that ability grouping effects may differ for subgroups of students. For example, Lou et al. (1996) found that low-ability students learned significantly more in heterogeneous groups, average-ability students benefitted most in homogeneous ability groups, and high-ability student group composition made no difference. Thus empirical analyses reveal that different intentional grouping practices can be expected to produce differential effects for low, middle, and high achievers. Alternative techniques of within-class grouping would be to group students based on their academic self-concept (Nielsen & Yerzinski, 2016), interests, motivations, and other student characteristics. However, in contrast to research on the effects of grouping on achievement, there is only limited research into the effects of differentiation on students' self-concept and other motivational and affective components (Pozas & Schneider, 2019). For instance, Schneider and Ludwig (2012) suggest that within-class ability grouping can negatively affect low-achieving students, whereas high-achieving students' self-concept is augmented.

The effects of mastery learning have been long documented within older meta-analyses. For instance, Kulik, Kulik, and Bangert-Downs (1990) analysed 108 studies with learners from college, as well as students from high school, and upper-elementary school. Ninety-six of these studies indicated that mastery learning programs had positive effects on students' achievement, mostly with moderate effect sizes. Moreover, 69% of the studies reported stronger effects for low-achieving students while 31% indicated stronger effects for high-achievers, which suggests potential aptitude-treatment interactions. In other words, such practice might have differential effects depending on the learners' particular characteristics. Hattie reported (2009), however, a substantial overall positive effect of 0.57 of mastery learning on student achievement.

Personalisation and differentiation: examining the benefits relevant to developing and middle-income countries

Although there is a large amount of empirical studies reporting the effects and benefits of personalised and differentiated learning on elementary, secondary, and postsecondary education, no research was reviewed that explicitly compares, addresses or discusses benefits for specific countries. There is research and literature, though, that discuss the impact that cultural contexts can have on how educational approaches and practices are transferred and adopted (Reza et al., 2019). Additionally, Smets (2020, personal communication) emphasized that differences between countries impact upon how personalised and differentiated practices are designed and implemented. It follows that the benefits of inclusive practices in developing and middle-income countries will depend upon how diversity is understood in those countries as well as upon the design and implementation strategies chosen. Nevertheless, in order to fully understand and identify the benefits for developing and middle-income countries, further

extensive cross-country comparative research on how personalised and differentiated instruction is implemented must be carried out.

Barriers and enablers

The analysis of the publications discussing the barriers and enablers of personalisation and differentiation revealed much common ground. Overall, both internal (teacher variables) as well as external (classroom-level, school-level, structural organizational conditions) were found to be important factors that can either hinder or support the use of inclusive practices. In the case of teacher-level variables like preparedness, professional development, and personal characteristics, research has shown that such variables may influence teachers' use of personalisation and differentiation (Smale-Jacobse et al., 2019). Extensive research on teachers' personal characteristics such as knowledge, attitudes, beliefs, mindset, and self-efficacy have been shown to either enable or hinder their actual in-class practice of personalisation and differentiation (Coubergs et al., 2013; De Neve and Devos, 2016; Dixon et al., 2014; Gaitas & Martins, 2017; Knauder & Koschmieder, 2019; Kopmann & Zeinz, 2016; Pozas & Letzel, 2019; Pozas, Letzel, & Schneider, 2019; Suprayogi et al., 2017). Furthermore, teachers need thorough content knowledge and a broad range of pedagogical and didactic skills to plan and execute differentiated instruction (Smale-Jacobse et al., 2019).

At the classroom level, the diversity of the student population (De Neve & Devos, 2016) and class-size (Suprayogi et al., 2017) may positively or negatively influence how teachers personalise or differentiate their instruction. In relation to school characteristics, a school principal's support can influence the implementation of inclusive approaches (Smale-Jacobse et al., 2019). Moreover, structural organizational conditions such as time and resources available for professional development, support from the school board, school track, school subject and teacher collaboration are key elements that function as enablers or barriers

to personalisation or differentiation (Gaitas & Martins, 2017; Pozas & Letzel, 2019; Pozas, Letzel, & Schneider, 2019). Lastly, country level policies that stress the need for personalisation and differentiation may significantly influence the adoption of such inclusive approaches. According to Mills et al. (2014, p. 345), personalisation and differentiation are “a complex concept, not easy to shift from policy to classroom context, and perhaps requires more careful explication at policy level and more support for teachers to enact”. Mills et al. (2014) report on the Queensland Teaching and Learning Audit carried out in Australia. This audit has the concern to examine the extent to which government schools differentiate classroom learning. The authors report in their in-depth investigation of the 2010’s audit, that although the requirement to differentiate classroom learning was implemented, it was adopted without any clarity of support. Data obtained from this study indicated that teachers had not been provided with a consistent message about what is meant by differentiation, nor adequate support for implementing this policy requirement (Mills et al., 2014)

Implications for educators and their professional development

Research focusing on professional development discusses the need for teachers to embrace student diversity in order to be able to address the needs of all students. In this vein, teachers are encouraged to rethink their educational processes in order to provide learning opportunities that successfully respond to the increasingly diverse student population. Although many experts and policymakers advocate personalisation and differentiation, many teachers regard the implementation of both practices as difficult task (Smets, 2017). Gaitas and Martin (2017) identified five domains of teachers’ perceived difficulties when implementing personalisation and differentiation; these are the activities and materials, assessment, management, planning and preparation, and lastly the classroom environment. Regardless of a teacher’s teaching experience, results from a study show that teachers

reported adapting instruction and conducting formative assessment as the most difficult elements of personalisation and differentiation (Gaitas and Martins, 2017). However, the same research has also shown that teachers with more training and who reported being prepared for DI were more confident about using personalisation and differentiation (Casey & Gable, 2012). We can conclude that studies have highlighted the importance of professional development as a means to encourage teachers to adopt personalisation and differentiation in their daily practice.

In a narrative review, Merchie et al. (2016) identify nine characteristics of effective professional development: (1) centre on the needs and questions of the teacher; (2) the content must be based on scientific research findings and linked to the teacher's questions; (3) the content is related to the teacher's goals as well as to the school's policy; (4) focus on linking theory and knowledge into daily teaching practice; (5) conduct inquiry-based learning and reflection on professional and academic knowledge; (6) should be held in an educational setting; (7) should occur through collaboration with internal and external colleagues; (8) a programme should be extensive and intensive with continuous feedback and support; and lastly (9) there is a competent supervisor that gives constructive feedback. In this context, Gheysens, Consuegra, Engels, and Struyven (2020) suggest that professional development programmes focused on stimulating the implementation of personalisation and differentiation should foster active learning through inquiry-based learning. The practice of personalisation and differentiation should be guided by teachers' beliefs and growth mindsets. Inquiry-based learning helps teachers to open their mindsets and encourage critical reflection on their classroom practice (Gheysens et al., 2020; Smets & Struyven, 2020). In addition, professional development programmes should strive to promote collaboration between external and internal peers. By discussing and coordinating their individual learning activities, teachers work on not only their individual competences, but also, they help stimulate the collective development of knowledge in the school (Gheysens et al., 2020). Further, the

authors argue that peer coaching and mentoring should be included within teacher professional development. Successful mentoring programmes must provide enough time for the communication between the mentor and the teachers, as well as for observations, and meetings. Moreover, both teachers and school administrators should prioritize its value so that teachers have sufficient time to explore the implementation of DI in their daily teaching.

Smets and Struyven (2020) designed a professional development programme that consisted of two consecutive phases. In the first phase, teachers learn about practical issues such as personalised and differentiated strategies, classroom management, and assessment. Additionally, discussions on growth mindset and perceptions on student heterogeneity are included in the programme. The second phase consists of an implementation period in which participating teachers are to be coached and given advice. In contrast, Gheysens et al. (2020) developed a training programme consisting of three phases. The first phase was focused on teachers establishing goals for themselves, the second phase involved taking actions to realize the goals they had established to make the classroom more inclusive. The third and last phase entails sharing the knowledge and experiences gained during their learning processes with the school team. Although the two professional development programmes are significantly different with regards to their length and way of managing the content of personalisation and differentiation, they both require that teachers not only obtain knowledge and information, but also that they put newly gained knowledge into practice. Only then are teachers able to gain confidence to implement personalisation and differentiation, as well as challenge and question their prior beliefs that hinders their adoption of inclusive practices. Results from the study by Gheysens et al. (2020) did not indicate significant quantitative changes in teachers' implementation of differentiation or personalisation. However, interviews did show that teachers with more training felt more confident in implementing differentiated practices. Furthermore, significant effects were found in teachers' ongoing assessment. In comparison to the control group, teachers taking part in professional development programme dedicated to

differentiation and personalisation reported a continuous use of assessment as a tool for both students and teachers in learning and teaching.

Conclusions

In this systematic literature review, 326 publications on personalised and differentiated teaching and learning were examined. The evidence obtained from this literature review suggests that both personalisation and differentiation are promising approaches to support learners and improve learning, particularly, but not only, for those learners that encounter difficulties. Furthermore, through the literature reviewed it was possible to build a theoretical model of personalised and differentiated learning for vocational education training and lifelong work-based learning. In this line, this model serves as a preliminary theorisation of how individualisation and differentiation can be framed in to vocational education training, lifelong learning and adult education. Given that the model is a first attempt to conceptualized both inclusive practices within a work-based learning approach, further research is necessary to refined, empirically validate, and evaluate the model. However, despite the lack of research and the scientific literature to be able to establish a theoretical and evidence-based model, the present literature review still allows to surmise the potential that personalisation and differentiation can have on the acquisition of 21st century skills, competences, and readiness of postsecondary, vocational, and lifelong learning learners.

The present literature review highlights as well the role that teachers have in a personalised and differentiated instruction. Further investment in teacher professional trainings are necessary in order to have a teacher workforce able to deal with the challenges that come with an increasing diverse learners' body. Additionally, school leaders and principals should establish inclusion as a top priority in their agendas and providing the resources that teachers need to be able to plan, implement, and evaluate personalised and

differentiated instruction. From a policy perspective, it is necessary that policymakers work to establish clear and transparent guidelines and requirements that both school leaders and teachers can transfer into the classroom. Taken these conclusions together, in order to create inclusive classrooms, it is important to create a common school vision. As Gheysens et al. (2020) state, most difficulties that teachers face with regards to the implementation of personalisation and differentiation are located at a school level. In this context, having a school development plan that contain a common shared vision and policy in place to facilitate the implementation of personalisation and differentiation encourages teachers to work together and implement strategies successfully (Gheysens et al., 2020, p. 12).

Outlook and further research

There is a promising potential for the implementation of personalised and differentiated learning in vocational education training and lifelong learning settings. However, further research should be conducted to explore whether the model proposed by this literature review is adequate to understand personalised and differentiated learning these settings. Moreover, certain research questions were not able to be fully responded with the literature identified in the study. Such questions are how personalisation and differentiation can be enacted and adopted across different learning environments as well as the benefits for developing and middle-income countries. Although this study attempts to provide some inferences, it is necessary for further lines of research to focus on exploring and investigating personalisation and differentiation not only from a theoretical point of view, but from an actual in practice experience across work-based learning settings and environments. Large scale studies that include conduct cross-country comparison research could shed further light into cultural differences and its effects on the views that define the benefits of personalisation

and differentiation. Further impact research could help to reveal the differences and relationships between different methods of differentiation and personalisation.

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