Rosalina Babo
Nilanjan Dey
Amira S. Ashour *Editors*

Workgroups eAssessment: Planning, Implementing and Analysing Frameworks

Springer

Intelligent Systems Reference Library

Volume 199

Series Editors

Janusz Kacprzyk, Polish Academy of Sciences, Warsaw, Poland

Lakhmi C. Jain, Faculty of Engineering and Information Technology, Centre for
Artificial Intelligence, University of Technology, Sydney, NSW, Australia;
KES International, Shoreham-by-Sea, UK;
Liverpool Hope University, Liverpool, UK

The aim of this series is to publish a Reference Library, including novel advances and developments in all aspects of Intelligent Systems in an easily accessible and well structured form. The series includes reference works, handbooks, compendia, textbooks, well-structured monographs, dictionaries, and encyclopedias. It contains well integrated knowledge and current information in the field of Intelligent Systems. The series covers the theory, applications, and design methods of Intelligent Systems. Virtually all disciplines such as engineering, computer science, avionics, business, e-commerce, environment, healthcare, physics and life science are included. The list of topics spans all the areas of modern intelligent systems such as: Ambient intelligence, Computational intelligence, Social intelligence, Computational neuroscience, Artificial life, Virtual society, Cognitive systems, DNA and immunity-based systems, e-Learning and teaching, Human-centred computing and Machine ethics, Intelligent control, Intelligent data analysis, Knowledge-based paradigms, Knowledge management, Intelligent agents, Intelligent decision making, Intelligent network security, Interactive entertainment, Learning paradigms, Recommender systems, Robotics and Mechatronics including human-machine teaming, Self-organizing and adaptive systems, Soft computing including Neural systems, Fuzzy systems, Evolutionary computing and the Fusion of these paradigms, Perception and Vision, Web intelligence and Multimedia.

Indexed by SCOPUS, DBLP, zbMATH, SCImago.

All books published in the series are submitted for consideration in Web of Science.

More information about this series at http://www.springer.com/series/8578

Rosalina Babo · Nilanjan Dey ·
Amira S. Ashour
Editors

Workgroups eAssessment: Planning, Implementing and Analysing Frameworks

Springer

Editors
Rosalina Babo
Porto Accounting and Business School
Polytechnic of Porto
Porto, Portugal

Amira S. Ashour
Department of Electronics and Electrical
Communications Engineering, Faculty
of Engineering
Tanta University
Tanta, Egypt

Nilanjan Dey
Department of Computer Science
and Engineering
JIS University
Kolkata, India

Preface

The use of collaborative work is increasing in various institutions. May they be higher education institutions, small or big companies, sporting organisations or other. This way of working can demand and improve a set of skills, such as cooperative ability, critical reasoning, creative thinking, responsibility, planning and communication. It also can provide motivation, learning opportunities and increase productivity. However, not every person has the same performance rate which leads to trust issues among the team members and a fault in the efficiency of the tasks. Hence, the assessment of the team members becomes an essential procedure, which can ensure that the individuals will meet the intended outcomes.

Each evaluator has their strategy to overcome issues and present viable solutions to distinguish team members and provide fair feedback. However, the way the individual contribution is assessed can be unclear and biased, and as a result, the evaluator has to resort to new methods of assessment. For that purpose, there are a variety of tools and techniques that can be used in several approaches.

This book seeks to overcome the assessment complexity using new frameworks and computer tools. It also reports the challenges and the new perspectives in developing e-assessment systems.

The book is a collection of nine chapters which are written by eminent professors, researchers and academic students from several countries. The chapters were initially peer-reviewed by the editorial board members who themselves span over different countries. The whole book is divided into two parts, namely Part I *Assessment and Collaboration* and Part II *E-Assessment Approaches*.

The first part, *Assessment and Collaboration*, comprises the following chapters and intends to provide a deeper understanding on the importance of assessment and collaboration, as well as some of the existing collaboration tools.

Chapter 1 by Katherina Gallardo tries to understand the importance of assessment literacy in the students' learning processes, by explaining the learning assessment practices according to psycho-pedagogical paradigms. Also, the significance of Information and Communication Technologies tools in the assessment

is explained. The chapter makes some recommendations in the form of "lessons" to assist the educators in improving their assessment practices.

Chapter 2 by Salim Chujfi, Hanadi Traifeh, Thomas Staubitz, R. Refaie and C. Meinel analyses the collaboration in online training environments with the use of an online course and that the assessment of digital remote teams can be successfully implemented by means of assisting team building and encouraging virtual participation.

Chapter 3 by Paz Prendes-Espinosa, Isabel Gutiérrez-Porlán and Pedro A. García-Tudela presents an extensive literature on collaborative tools and their functionalities. It analyses the possibilities of collaboration in higher education with real examples.

Chapter 4 by Dalbert Oliveira and Ana Lúcia Terra explains in a more personal way the use of online collaborative tools, as well as their strengths and weaknesses. It uses the life history methodology to acquire information and carefully analyse the data that was gathered first hand.

Chapter 5 by Catalin Popescu and L. Avram provides an insight on online questionnaires and whether these are reliable to consider all the information related to project implementation. It intends to be a good practice guide in the implementation of projects to introduce new study programmes.

The second part, *E-Assessment Approaches*, composed by the following chapters, presents different approaches and tools to carry the assessment process.

Chapter 6 by Bastian Küppers and Ulrik Schroeder concerns the development of a framework to conduct evaluations in HEI with a Bring Your Own Device (BYOD) approach. The authors developed an application for electronic exams on students' devices in a BYOD environment: FLEX. FLEX's main goal is to be a software solution that enables electronic assessments within the MATSE educational program.

Chapter 7 by Joachim Maderer and Christian Gütl explains the need of a flexible and adaptive assessment system. This system should be able to: be integrated with different learning environments; recognize skills and the application of knowledge; and reuse learning and assessment items. Therefore, this chapter presents the Antares framework, its architecture, assessment interface, assignment and assessment engine, as well as an example of its working.

Chapter 8 by Paulo C. Oliveira, O. Constante, M. Alves and F. Pereira provides an interesting study in one Portuguese higher education institution, involving the use of electronic tools to assure that the students perform their preparatory work in advance to the laboratory classes.

Chapter 9 by Ursula Niederländer and Elisabeth Katzlinger provides a discussion on the use of a LMS Moodle plugin "StudentQuiz" to allow students to create questions and answers. This method also allows them to test, comment and rate the questions of their classmates.

The authors address important matters on assessment and e-assessment, collaboration environments and tools, as well as different and new assessment practices. Those interested in using new technologies and different learning environments will benefit from these studies. We hope that this book will assist researchers and students interested in carrying out further research in this area.

Porto, Portugal   Rosalina Babo
Kolkata, India   Nilanjan Dey
Tanta, Egypt   Amira S. Ashour

Contents

About the Editors

Rosalina Babo is Coordinator Professor of Information Systems Department, School of Accounting and Administration of Polytechnic of Porto (ISCAP/IPP), Portugal. Since the year 2000, she is Head of the Information Systems Department and for about 12 years acts as a member of the university scientific board. Rosalina's international recognition was improved with the opportunity to be Visiting Professor at several universities in different countries, namely Belgium (KU LEUVEN), Croatia (University of Split), Kosovo (University of Prishtina), and Latvia (Latvia University of Agriculture). Rosalina was one of the founders of CEOS.PP (former CEISE/STI) research centre and its director for 5 years. Rosalina has served on committees for international conferences, and acts as a reviewer in scientific journals. As Book Editor, she collaborates with publishers such as Elsevier, Springer and IGI Global in the fields of data analyses in social networks and e-learning. Having several published papers, her main areas of research are e-learning, e-business, Internet applications focusing on usability and social networks.

Nilanjan Dey is an associate professor in the Department of Computer Science and Engineering, JIS University, Kolkata, India. He is a visiting fellow of the University of Reading, UK. Previously, he held an honorary position of Visiting Scientist at Global Biomedical Technologies Inc., CA, USA (2012–2015). He was awarded his PhD from Jadavpur University in 2015. He has authored/edited more than 70 books with Elsevier, Wiley, CRC Press, and Springer, and published more than 300 papers. He is the Editor-in-Chief of the International Journal of Ambient Computing and Intelligence (IGI Global), Associated Editor of IEEE Access, and International Journal of Information Technology (Springer). He is the Series Co-Editor of Springer Tracts in Nature-Inspired Computing (Springer), Series Co-Editor of Advances in Ubiquitous Sensing Applications for Healthcare (Elsevier), Series Editor of Computational Intelligence in Engineering Problem Solving and Intelligent Signal Processing and Data Analysis (CRC). His main

research interests include medical imaging, machine learning, computer-aided diagnosis, data mining, etc. He is the Indian Ambassador of the International Federation for Information Processing—Young ICT Group and Senior member of IEEE.

Amira S. Ashour is Assistant Professor and Head of EEC Department, Faculty of Engineering, Tanta University, Egypt, since 2016. She is a member of the Research and Development Unit, Faculty of Engineering, Tanta University, Egypt, from August 2019. Ashour is Engineering Manager of Huawei ICT Academy, Tanta University, Egypt, from September 2019. She was Vice-Chair of Computer Engineering Department, Computers and Information Technology College (CIT), Taif University, KSA, for one year from 2015. She was Vice-Chair of Computer Science Department, CIT College, Taif University, KSA, for 5 years till 2015. Her research interests include biomedical engineering, image processing and analysis, medical imaging, computer-aided diagnosis, signal/image/video processing, machine learning, smart antenna, direction of arrival estimation, targets tracking, optimization and neutrosophic theory. She has 20 edited books and 4 authored books along with about 200 published journal and conferences papers. She is Series Co-Editor of Advances in Ubiquitous Sensing Applications for Healthcare series, Elsevier.

Part I
Assessment and Collaboration

Chapter 1
The Importance of Assessment Literacy: Formative and Summative Assessment Instruments and Techniques

Katherina Gallardo

Abstract Almost sixty years after Scriven and Bloom's accurate description and differentiation between summative and formative assessment, it would be quite vain to make sure that educators nowadays fully understand and use these two types of evaluation in their practice. Besides, it would be riskier to expect educators to use programs or design AI algorithms to make appropriate decisions to select and design instruments to make accurate judgments about learning and performance results without considering the difficulties in learning evaluation practices that have arisen in different educational contexts. The understanding of paradigms, educational models, and beliefs of educators around assessment practices constitutes mandatory tasks to consider as a point of departure in the era of ICT for learning purposes. Thus, the main objective of this chapter is to review the importance of evaluation literacy towards the complex challenge of planning, designing instruments, and interpreting results derived from learning assessment. Then, a reflection on the advances and difficulties found by researchers in different countries on formative and summative practices and results in higher education mainly is discussed. By the end of this chapter, some recommendations related to educator's training for improving and reinforcing conceptual and instrumental assessment practices are envisaged.

Keywords Assessment literacy · Formative assessment · Summative assessment · Higher education · Meta-evaluation

1.1 Introduction

Formative and summative assessment can be considered a worldwide educational topic based on the number of reports, scientific articles, and books published in the lasts three decades. On the one hand, UNESCO, OCDE, and World Bank as the

K. Gallardo (✉)
School of Humanities and Education, Tecnologico de Monterrey, Monterrey, México
e-mail: katherina.gallardo@tec.mx

more relevant international organizations associated to educational matters around the world have established totally or partially global as well as local recommendations to profit these two types of assessment as powerful ways to improve learning [56, 76, 82].

On the other hand, also educational researchers are interested in studying formative and summative assessments in daily classroom activities as it has been proved that both types in different ways influence students' academic progress [47, 54, 84]. Besides, formative and summative assessment becomes a more complex topic when variables such as teacher experience, type of contents, and social and cultural contexts are involved in the understanding of assessment planning and results [53].

Moreover, in several learning scenarios, formative and summative assessment are now supported by ICT tools. Educators use different kinds of information and communication technology (ICT) applications to plan, design instruments, design activities, analyze results, grade, and give feedback to students [83]. The options of electronic tools for assessment tasks have increased exponentially in the last five years. Undoubtedly, new and more natural ways to conduct formative and summative assessment will keep rising in the next years supported by AI and machine learning [1, 36].

Even if new and useful knowledge on formative and summative assessment as well as innovative ICT assessment applications are available for improving these particular educational tasks, it can also be affirmed that there are still many difficulties to solve around classroom assessment practices. These difficulties are mainly related to assessment literacy and educators' beliefs about assessment [4, 75].

The objective of this chapter is to get a deeper understanding of how vital assessment literacy is. Then, it is relevant to reflect upon this topic seen within the complexity of the educational, social, and cultural environment. These reflections will permit to give some punctual recommendations around formative and summative assessment practice for higher education mainly, regarding a near future where ICT use for learning assessment becomes foreseeable.

1.2 Paradigms of Education and Educational Model

It is considered appropriate to begin this section by stating some clue ideas about the importance of psychopedagogy paradigms as well as the influence educational models must have on learning assessment. On the one hand, a paradigm can be defined as a mental representation of how an item or an idea is structured and how it functions in a specific context and time. The legacy of the last century on the development of psychological approaches related to human learning has left a considerable inheritance. Thus, five psycho-pedagogical paradigms arose: Behavioral, Humanist, Cognitive, Sociocultural and Constructivism paradigms have been considered for years as role models in the teaching–learning process [16, 35].

On the other hand, an educational model is the application of educational paradigms that an institution assumes and serve as a reference for the functions it

fulfils: teaching, research, and establish links with other institutions, to carry out an educational project. Then, an educational model is based on the institutional history, values, vision, mission, philosophy, objectives, and formative purposes [78]. Indeed, the learning model is a conceptual framework that describes a systematic procedure in organizing learning experiences to achieve specific goals and serves as a guide for implementing the learning activities. Undoubtedly both, the psycho-pedagogical scope, as well as the institutional orientation, give meaning to educational practice. Then, the essence of the educational process influences the approach educators takes to plan, execute activities, and assess learning outcomes [37].

These statements are useful to understand that learning assessment not only refers to techniques or procedures in isolation [66]. The way an institution explains the essence of its educational orientation and model influences directly in the main decisions related to the establishment of learning and teaching strategies, methods, techniques, and practices. Then, the point of departure for educators should be these questions: what decisions am I taking to conform an assessment system in concordance to paradigms and educational model of the institution? Is my assessment practice in agreement with the institutional, educational goals? Unfortunately, these questions are rarely asked.

Apparently, in most of the cases, it is not well understood that paradigms in various ways guide relevant formative decisions. For instance, from the Behaviorist paradigm, it is understood that the learning process is related to accomplish specific learning tasks and that the level of accomplishment is represented on quantitative results and get meaning into a scale. The educational model based on objectives is closely related to this learning scope. Its statements configure the teaching and learning tasks. Then, learning assessment is based on practices to collect specific information on the acquisition of certain knowledge that permits either success in reaching a certain level of learning and achievement or failure.

On the opposite side, from the Cognitive paradigm, it is expected that learning process is focused on thinking processes, going from simple to complex that permit learner to identify, comprehend, analyze and use knowledge for solving problems [16]. The educational model based on thinking development emphasizes the achievement of autonomous reasoning. In this direction, learning assessment should be a focus on a variety of activities and mechanisms to promote the understanding of the own learning style, thinking process, and appropriation of knowledge. Then, assessment results get different meanings to the learner, going beyond a numerical scale of success or failure.

In the understanding of the author, statements around how psycho-pedagogical paradigms and educational models configure the educational intention, this point should be considered the cornerstone of the principles that rule assessment decision-taking in the classroom. To the extent that educators consider these psycho-pedagogical fundamental elements into their practice, taking decisions around assessment would be more coherent and aligned to educational goals.

1.3 Formative and Summative Assessment

Learning assessment was classified as formative and summative assessment six decades ago. Since Scriven's masterpiece published in 1967, several explanations and discussions have emerged around this classification up to now [65]. The level of relevance of the understanding of what these two types of assessment require and offer to students and educators is considered high.

In this section, readers can find a brief appreciation of the evolution of these concepts and the actual meaning of them. From these two types of assessment, it could be affirmed that formative assessment has been a more debated topic than summative assessment, not only from the psycho-pedagogical view but from many other disciplines.

The first definition of formative assessment given by Scriven was referring to provide some data that permit successive adaptations of a new program during the phases of development and implementation [65]. A few years later, the concept of formative assessment was adopted by Benjamin Bloom to enhance his definition of mastery learning [12]. A first feature that defined formative assessment was its role for closing learning goals gaps between the actual level of the work and the required standard. Then, specific corrective activities could be designed and done to correct learning difficulties [25].

In the '70s, Bloom's understanding of the potential of formative assessment was also enriched by practical recommendations. His initial proposal follows the establishment of some strategies that educators could do during instruction, such as: use formative assessment after each lecture, design and apply formative quizzes, give feedback and correction to each student as a way to reach remediation, assess the level of achieved standards in parallel to all learning objectives, assign a positive perspective to sanitation as its benefits towards improving students' achievement.

The decade of the '80s was crucial for getting to a better understanding of the possibilities that formative assessment gives to students and educators. Thus, it was found that useful feedback as possible as long as students develop their capability to judge the quality of their work [59, 60]. This statement guided educators to reinforce and renew some instructional practices as well as assessment techniques such as establishing standards students may refer to the beginning of the learning process for making judgments of their progress and work autonomously.

During the '90s, some other related variables and effects were studied around formative assessment practices beyond cognitive aspects. Then, self-assessment, motivation for learning, engagement, as well as communication around feedback considering the relationships among students and teachers as well as the social context, were studied as factors that could affect formative assessment results. Besides, findings around specific needs and complementary skills educators have to learn and develop for conducting this type of assessment were discussed [53, 55]. Some emergent concerns went around the lack of pedagogical preparation and practice for doing formative assessment practices in the classroom, specifically in tertiary education.

In the first decade of the new millennium, the number of studies about formative assessment specifically increased a thousand per cent concerning last decade scientific production [64]. Indeed, critical new elements were found and discussed. In the first place, it can be considered trustworthy that theory about formative assessment had been proposed [10]. Necessary elucidations were made about the types and moments of interaction with the teachers, learners, and the subject discipline; the teacher's role towards the regulation of learning; the feedback and the student–teacher interaction to get to an understanding about strengths and gaps for reaching learning goals; and the student's role in the learning process, as peer and as owner of the learning process.

In addition to this new theoretical input, it also was published a feedback model from a meta-analysis [28]. According to the authors, this feedback model was possible after working with 500 meta-analyses, involving 450,000 effect sizes from 180,000 studies, representing approximately 20–30 million students, on various influences on student achievement. This effort permitted to conclude that feedback has almost the same impact on learning than instruction. Besides, the model enhanced the role of students as the center of the knowledge and reflecting process. Moreover, the model indicates the position of educators as a guide and support along any learning path. Nevertheless, some other studies of this decade were not precisely aligned to encounter more explanations of the benefits of formative assessment for learning. In this decade, some studies were conducted to criticize and questioned the power of formative assessment [18, 57]. The main counterpart ideas were focused on weak theoretical foundations and lack of reliable results about the positive effects of formative assessment in the classroom. Specific suggestions that arose from these studies were related to the use of appropriate methodologies, and statistical techniques to make possible real improvement of instructional practices.

In addition to the publication of profound studies around formative assessment theoretical statements and several applications in the instructional process, the design of different ICT solutions considering correspondence to international formative assessment standards was also a characteristic of this decade. In this concern, specific developments such as the Classroom response systems supported on Technology-enhanced formative assessment were applied and studied. This technology was proved to use sets of questions working together to target instructional objectives on science education purposes [8, 83]. Some other applications like Alice [32] were design for improving data collection, reducing the loss of data, and improving the quality of the assessment instruments obtained from formative assessment practices to benefit results of summative assessment in terms of validity.

In the second decade of the new millennium (from 2010 up to now) the number of published articles, proceedings, and books about formative assessment has tripled the number of publications corresponding to the period 2000–2009. From all these contributions, three topics are considered relevant for strengthening conceptual and practical elements of formative assessment. The first one is the continuous revision of the theoretical and practical aspects, going further face to face modality [9, 38]. The second relevant topic is the design and use of holistic and analytic rubrics as a way to respond to the formative assessment principle of establishing standards

and criteria from the beginning of the learning process and make clear the expected performance level for complex tasks [26, 49]. The third relevant topic is about the incursion of new technological development for introducing 2D and 3D consoles in the classroom as well as online games. These resources open a broad kind of possibilities for amusingly conducting formative assessment for millennials and *Z* generation students [30, 77].

In the side of summative assessment, the first definition expressed that this type of process serves to understand if the object being evaluated (program, intervention, and person) met the stated goals. Years later, some other definitions enriched this first appreciation, giving a more detailed meaning determining summative assessment as the judgement which encapsulates all the evidence up to a given point. This point is seen as a finality at the end of the analysis [73].

Summative assessment, contrary to formative assessment, has experimented with different pace of publications along the last six decades. The number of products around this topic has reached just 10% in comparison to formative assessment in the same period. The most related items allied to summative assessment in these publications are reliability, validity, test design, teaching, scoring system, and accreditation [64].

Curiously, in the most cited article of summative assessment along these almost 60 years [39] there are quite important issues that point out several problems found in the educational practice in different directions: conceptualization, instrument design, and establishment of judgments from the results. Three outstanding reflections found in this article are:

- The relevance of accuracy and reliability as quality test factors in most of the cases oblige educators to turn into pieces of curriculum content that had been learned not in isolation but in interrelation to other elements in authentic situations. In the words of the author, here there is a typical case of the juxtaposition of engagement and quality.
- The establishment of criteria derived from learning goals, a process that can take a lot of time and effort, especially for complex skills. In most of the cases, after testing students and giving a grade, it is impossible to know what criteria have been used or what meanings had been attached to them; Remove any existing section breaks.
- The misunderstanding of grading in local, regional, and global contexts. On the one hand, a grade opens a silent gap that makes the learning processes involved invisible. On the other, the context factor (learning conditions, and abilities of the test designer) makes it impossible to rely on a final grade as a warrant of learning. In this third point, assessment validity is reluctant.

Finally, there is a convergent point that must also be understood. Assessment in the classroom goes far beyond a confrontation between formative and summative assessment practices. The integration of both types of assessment, as Scriven affirmed, needs to be done for constructing a reliable assessment system. In the literature, several studies highlight that the coexistence of formative and summative in harmony along the learning process benefits students' academic performance and

achievement as well as give valuable information to educators for improving instruction [24, 31, 51]. For this reason, some technical and instrumental aspects related to both, formative and summative assessments are addressed in the next sections of this chapter.

1.4   Assessment Literacy

Educators impact students' learning process every day. Several factors could make the learning process a profitable experience to obtain positive effects: the application of specific teaching methods, the selection of the didactic and reading materials as well as the decisions educators might take on learning assessment. Then, knowledge, skillss and understanding around learning assessment decisions could be defined as the complex task of assessment literacy. Nevertheless, this definition stays quite simple in comparison to what preparation for executing learning assessment processes implies.

The work of assessment literacy in this section of the chapter is focused on its relevance. It is considered a concept that goes beyond school frontiers. Thus, assessment literacy integrates not only theoretical but personal, institutionals and social elements in its complexity. Figure 1.1 contains the items that conform to a proposal for assessment literacy model that, according to the author, integrates the crucial factors for its understanding and practice.
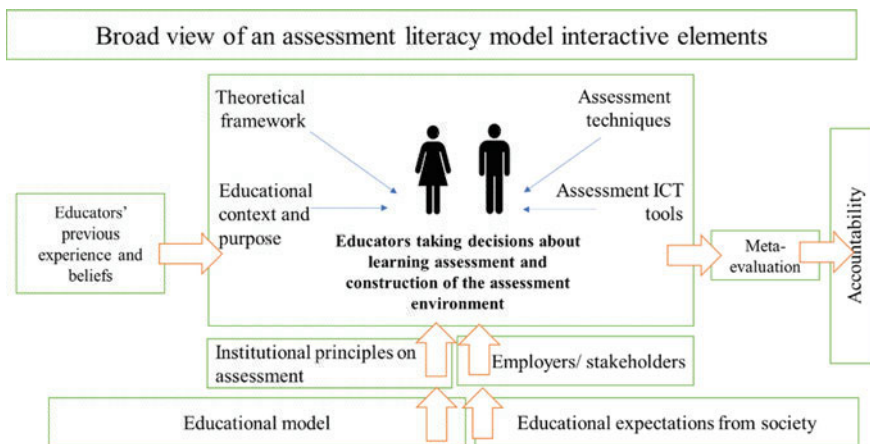

Fig. 1.1   Assessment literacy model: integration and interaction of main elements

1.4.1 Beliefs and Decision Making for Learning Assessment

Educators' beliefs as a research subject of interest and its influence on students' achievement and performance have taken great importance in the last years as part of the elements that conform to the assessment literacy task. Educators' beliefs could be defined as a set of conceptual representations which store general knowledge of objects, people and events, and their unique relationships [29]. Several studies in the last decade have indicated that studies on educator's beliefs are especially useful to understand teachers' perspective and practices related to their goals and actions in their professional practice [21, 63].

An excellent way to understand the relevance of this topic might be through the following statement that contains some meaning about beliefs and the connection to teaching practices: If an educator believes that teaching mainly consists in the transmission of knowledge, then students' role could be circumscribed to the passive accumulation of information. Nevertheless, if this belief changes and transforms educators' approach of teaching into a co-constructive process that involves teachers and students to reach a goal, then; as a result, a higher possibility of transforming educational practices could happen. This new belief would open up a new understanding of teaching as a way to support students' learning to stimulate their engagement and interest in learning in specific topics with practical ways to do so instead of passive.

The statement above can also be understood from the framework of assessment practices. Indeed, some of these educator's beliefs studies integrate exciting facts about educators' decisions around learning assessment [7, 14, 23, 80]. Relevant aspects could be summarized in this point to fully understand the relevance of teachers' beliefs in assessment.

- Few studies have explicitly examined teachers' beliefs up to now in relation to learning assessment process. There is a need to continue making research about influences of teachers' past and current experience on design and analysis of assessment in the classroom [7, 14].
- There is a need for giving relevance to academicians' beliefs about learning to pursue meaningfulness in teacher training programs [7]. The inconsistencies found from beliefs to practice help identify relevant aspects to incorporate in teachers' training programs or to reconsider in institutional norms about assessment [80].
- The understanding of beliefs about assessment permit to identify if either internal or external factors are guiding the learning assessment process when analyzing educators' daily practice [14, 23].

1.4.2 Theoretical Approaches Related to Learning Assessment Practices

Assessment literacy is a complex task that involves theories from the psychopedagogical approach that sustains its practices. As it was explained before, the learning paradigm, as well as the educational model, are clue elements that guide formative ideologies and actions [16, 78]. Then, these theoretical elements influence directly the way educators understand and decide how to conduct assessment procedures, accompanied by their previous experience and beliefs.

On the one hand, theoretical approaches from Behaviorism, Cognitivism, Constructivism, Humanism, and Sociocultural or Situated approach indicate specific features that the educational process must contain. This same phenomenon happens around learning assessment and configures the way to conduct formative as well as summative assessment decisions in the classroom. In Table 1.1, some foundations of learning and assessment practice are displayed [34, 35].

On the other hand, there is a branch of complementary psycho-pedagogical theoretical approaches that support explanations about not only how human beings are capable of learning contents, but also movements as well as manage social and emotional elements in interaction with others. These referential frameworks are known as learning taxonomies. Learning taxonomies feature a well-defined hierarchy of categories that attempts to capture the spectrum of learning processes: These taxonomies are helpful tools educators use for planning, instrumenting, and implementing assessment techniques. This is the reason why taxonomies also constitute a relevant aspect to consider in assessment literacy.

In literature, Bloom's learning taxonomy [11] could be considered one of the most popular of the last century. Bloom and his colleagues developed an interesting proposal for understanding the way human dimensions such as cognition, psychomotor, and emotional -affective domains can be distinguished from the instructional aspect. Bloom's masterpiece has been revised and counts on enriched contents [5]. Nevertheless, other proposals are as quite remarkable as Bloom's. Marzano and Kendall's New Taxonomy [43] offers a different point of view to understand the connections between contents and cognitive procedures. The authors have also implemented a proposal for the psychomotor domain. Besides, there is another proposal: Experiential Domain taxonomy [48] based on the understanding of experience as a hierarchy of stimuli, interaction, activity, and response with exposure and culminating in the dissemination.

Even though the intention of this chapter is not to give a profound resemble of the use of each learning taxonomies, it is highly recommended to consider that educators need to learn and apply them as a crucial theoretical element. There are specific benefits, while taxonomies are regarded in the assessment process [33]:

- Educators need to refer to a common framework to understand the learning process and make the individual as well as collective decisions about progression and actions.

Table 1.1 Foundations of learning and assessment practice

Theoretical approach	Learning foundations that configure learning assessment perspectives
Behaviorism	Learning is a conditioned response to external stimuli Rewards, withholding, and punishment are the most used ways of forming or extinguishing habits Learning can best be accomplished when elaborate performances are decomposed into parts Each element that conforms to a complex learning process should be practiced and reinforced Only observable behaviors are valid elements to give a judge about the sufficiency of learning Achievement is often equated with the accumulation of skills and the memorization of information in a given domain, that allows the learner to provide a rapid answer and demonstrate accurate performance
Cognitivism	Learning is determined by what people think and need Learning requires the active engagement of learners There is an emphasis on understanding as a way to reach learning goals Educators' primary role is to help novice students to acquire expert knowledge of conceptual structures and processing strategies Problem-solving is seen as a didactic means for knowledge construction Deductive and inductive reasoning are essential as evidence of analytic thought
Constructivism	Prior knowledge is a powerful determinant of a students' capacity to learn new things Learning principles go around how people construct meaning and make sense of the world through structures and concepts Construction of knowledge and meaning happens in community. Students work primarily in groups
Sociocultural or situated	The constant interaction between actions alters the context. Then, the context changes thinking Learning is a social and collaborative activity. People develop their thinking together. Then, conforming learning communities is part of the learning process Knowledge of not abstracted from context but seen in relation to it. Then, it is difficult to judge if an individual reached the learning goals from decontextualized situations
Humanism	The learning process implies the activation of cognition, emotion, interests, motivation, and potential of students The understanding of students' inner thought makes clear their difference in interests, needs, and experience while learning Good teacher-student interaction is mainly considered for promoting positively in constructing the learning environment Teachers reflect on their teaching style and attitude to understand themselves as educators and improve their acts continually

- Common frameworks in the different domains (cognitive, psychomotor, or affective-social) could give clear and justifiable reasons to link objectives, assessment, and outcomes, with appropriate teaching and assessment methods.
- Educators, as well as students, could revise learning progress in the different levels of the domain according to expected performance.

1.4.3 Assessment Techniques: Suggested Procedures to Make Decisions

In this chapter, assessment techniques refer to all the possible ways educators can take to plan and design tasks or instruments for collecting information that reflect students' performance. At this point, it is essential to clarify that these techniques are not intended and applied in isolation. Indeed, this becomes part of the classroom assessment environment where assessment purposes, tasks, performance criteria, and standards derive in the production of learning outcomes and later statement of feedback [13]. This environment is a product of assessment choices connected to the theoretical elements, the educational model, and the institutional operational features: format, frequency, and instructional functions.

Interminable discussions could be included in this section about where to start designing an assessment environment as well as which and how many assessment techniques should be included. Assessment literacy studies show several standpoints on how to do so [31, 40, 45, 61]. Figure 1.2 has been designed for explaining a suggested way based on assessment literacy literature. This proposal is divided into
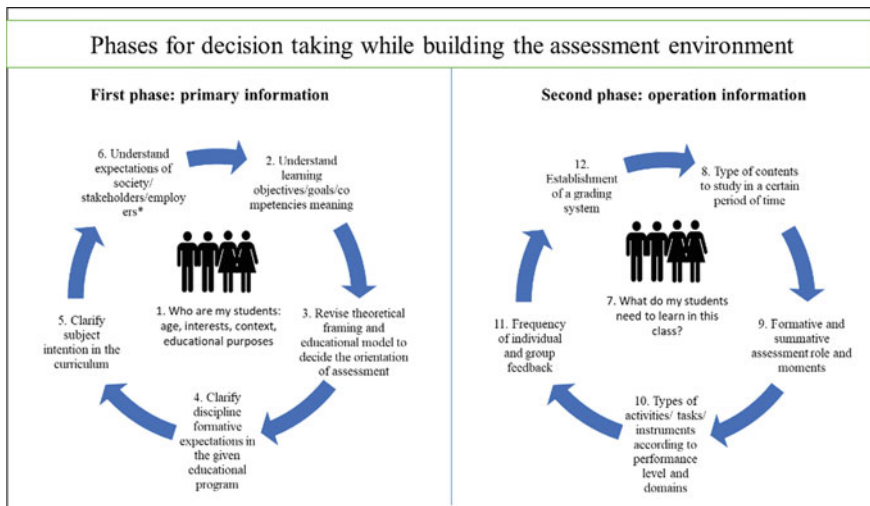

Fig. 1.2 Phases for learning assessment decision taken by educators

two phases for primary and secondary decisions while building or improving the assessment environment.

The first phase of the process permits educators to reflect upon different general aspects. It would be possible that the answer to these first six items permit educators to establish stronger ideas about the relations among students' characteristics as learners, institutional, educational model and expectations about the educational process, identify where the subject matter is located concerning others. Besides, society, stakeholders or employers needs and expectations about educational outcomes are also part of this complex reflection. It is also recommendable to revise materials containing information about opinions and hope of society in general and employers in particular, especially in the case of higher education scenarios.

The second phase goes directly to the assessment process to be planned and followed in the classroom. Steps 7 and 8 permit educators to specify learning needs in a target population. Steps 9 and 10 are directly connected to the theoretical approach and learning foundations (see Table 1.1) as well as with the learning taxonomies selected for organizing and systematizing learning progression. At these points, educators need to establish the intention of assessment according to objectives, goals, and content for then determining when and how the assessment process will take place. Finally, with steps 11 and 12 educators can end up the assessment cycle by deciding the frequency of feedback, the way it is going to be delivered and the organization, and the grading aspect according to the institutional principles.

As can be inferred from all the above, the construction of the assessment environment is a complex task that demands reflection, sensibility, and preparation from educators. Assessment literacy principles are dynamic contents and processes that required constant interaction, thinking, and decisions among educators, directors, and social agents, all interested in pursuing an assessment process that benefits students to reach their learning goals.

1.4.4 Workgroups Assessment

Collaboration has become a relevant competence to be developed along with higher education. It is considered a valuable soft skill for further professional development as well as a powerful indicator of employability [41]. Collaborative work is defined as students working together in groups within a physical or virtual environment towards defined learning purposes and goals. It could be done with some or no tutor surveyance [15].

The success or failure of collaborative work depends on many different variables such as the number of students in a group, the possibility or not for students to choose group members, rules establishment, frequency of group meetings, and sense of responsibility [9]. Nevertheless, one of the main elements for collaboration to become a successful means for learning is related to assessment decisions and practices. At this point, educators need to select the grade in which students will have certain participation while executing both, self and peer assessment along

with their collaboration experience as well as how this participation will configure feedback and grades. Steps 9–12 (Fig. 1.2) are referred to organize the process and explore the possibilities educators have to choose assessment practices for conducting collaborative work.

Step 9 makes it possible to make some initial decisions: how to explain the intention of each type of assessment, formative or summative, and the role students will have in each one. First, it is important to make clear for students the difference between both types of assessment: formative refers to ways to reaching learning goals working on the actual level of the work and the required standard, while summative permit students to count on a holistic type of judgment which encapsulates the learning evidence up to a given point [74]. Then, educators need to clarify from the beginning of how formative and summative assessment methods will be applied. From this point, the expected level of performance should be established. If performance integrates different dimensions as cognitive, psychomotor, and social-affective elements, criteria for assessing each dimension should be explained as well as the ways to qualify them.

Step 10 refers to the type of assessment activities. Educators are asked to establish at least three elements:

- The timetable for organizing collaborative work
- The inclusion and use of self-assessment and peer-assessment within formative and summative purposes
- The way self and peer assessment results affect or configure feedback and grading. These assessment activities should be carefully chosen. In the case of self-assessment, at least four different scopes could be selected [48, 67]: self-grading, self-rating by using certain criteria established by the educator in a rubric, self-rating by using students' criteria and standard self-assessment and learning contract design, applied only if students are also asked to decide contents as well as activities to get to a certain learning goal. In the case of peer assessment, at least three varieties could be used: peer feedbacking and peer grading with the option of personalizing each group member grade by making an algorithm for obtaining an index calculation (from 0 to 1) to multiply final group grade or add points to the final result. Besides, educators will decide if peer assessment will have to be managed in quantitive and qualitative way and if anonymously [46, 69].

Step 11 refers to the need of establishing dates and ways to participate in self-assessment and peer assessment. It is important to clarify specific dates as well as the use of forms, surveys, questions, and scales they will be using for handing these types of information.

Step 12 refers to establish how partial and final grades are configuring final results for group and individuals. All the decisions taken in step 10 should be well-structured at this point for avoiding confusion or argues along with the collaborative work.

1.4.5 ICT Tools for Assessment

For decades, learning assessment has also been an educational phenomenon of interest for computing engineers. E-assessment denotes end-to-end electronic assessment processes where ICT is used for the presentation of assessment activity, and the recording of responses. Interdisciplinary efforts in this matter have been designed for solving general as well as specific problems while conducting the formative or summative assessment. As a result, nowadays, educators can count on numerous possibilities of electronic assessment tools. It can be affirmed that these tools have been developed mainly to attend to the need for conforming question databases to design and apply quizzes and tests. Strategies related to strengthening the expertise of students responding quizzes to improve final summative tests results have been widely considered [17, 44].

Significant benefits of ICT tools for assessment have contributed to the fast development of these solutions: fewer hours devoted to testing design, lower administrative costs in the reproduction and application of tests, automatic, accurate statistical analysis of items and for obtaining more consistent tests, and more possibilities of sharing database and results for different publics. These are just a few of the advantages of the integration of these computing solutions to assessment environments [44].

Besides, the increasing interest in the online education modality has potentiated the need in the development of more reliable assessment tools [22] that count on some specific requirements as usability, accessibility, and interactivity for planning and conducting learning assessment. Recent research offers a classification of assessment tools typically used in online and blended learning modalities after a systematic literature review [20]. As a result, it is stated that educators can count today on manual assessment tools, semi-automatic assessment tools, and automatic assessment tools. The second and third options are most famous as the main objective of using these tools is to support immediate feedback. This action implies the delivery of results after the assessment process in the shortest period.

One distinctive of the evolution of these tools is the insertion of new concepts to enrich formative assessment intention. The practice of just applying questions randomly, collect information about students' score, and give automatic feedback have evolved. There are new proposals that integrate gamification as a motivating way to reach learning goals [79, 85]. There are also new alternatives that stimulate smiling while responding to formative assessment activities as a way to elevate motivation and satisfaction levels to maintain learning engagement [81].

Electronic tools for designing rubrics and compile portfolios constitute another critical branch of application development that have helped educators to create and establish both, criteria and performance level for formative or summative assessment intentions [2, 67]. Nowadays, it is quite common to find this type of tool available as an independent open-access application or as part of LMS assessment functions. The advantages of design rubrics using electronic applications are vast:

- High possibilities of working in teams rather than in isolation for the establishment of relevant criteria and expected performance.