AN ASSESSMENT CLASSIFICATION OF FORMATIVE EVALUATION TOOLS AND DIGITAL TOOLS

Rosa Sandra Paiva[1], Lia Oliveira[1], Luís Paulo Reis[2]

[1]Estudos Curriculares e Tecnologia Educativa, Instituto de Educação, Universidade do Minho (PORTUGAL)
[2]Departamento de Engenharia Informática Faculdade de Engenharia da Universidade do Porto (PORTUGAL)

Abstract

The theme "*An assessment classification of formative assessment tools and digital tools"* represents the meeting between a theme with a history in education - formative assessment, and another very current theme - the use of digital tools with an emphasis on commonly called apps (digital apps). The formative evaluation presents numerous scientific evidences of its potential in supporting students and teachers in overcoming weaknesses and deficiencies, with very positive impacts in terms of motivation, engagement, achievement and autonomy, thus justifying a study on the difficulties in rooting. Technology can guarantee a greater rootedness and a performance more aligned with inclusive education, considering the student's profile after leaving compulsory education. The qualitative methodology was adopted. The technological environment by nature stands out for its ease and efficiency in the collection, organization and treatment of data, thus meeting, one of the main limitations of formative assessment is the difficulty in collecting data on the interaction of learning and results as well as the analysis of formative feedback and evaluation. The results obtained allowed us to conclude that was possible and a new model of classification of apps for formative evaluation was built. The structure of our model comes from the correspondence between the characteristics and the purposes of the tools and / or techniques of formative assessment, and the potentialities and functionalities of applications for mobile devices, in an intrinsic link to Bloom's Taxonomy (2001). This classification was built from three classifications. One classification focuses on formative assessment techniques and cognitive development goals, another organizes apps by type of pedagogical activities, and finally, another organizes, not apps, but web tools serving cognitive development goals concerning a 1956 version of Bloom's Taxonomy.

Keywords: formative assessment; summative evaluation; digital tools; classification of apps, use of ICT in Education.

1 INTRODUCTION

The theme "*A classification of formative assessment tools and digital tools"* represents, simultaneously, the encounter between a theme with a history in education - formative assessment, and another very current theme - the use of digital tools with an emphasis on apps. In contrast, the first seems not to take root in pedagogical practice and the second gains great support by the general public.

This study presents about fifty formative assessment techniques, linked to cognitive development goals, in their most current version and integrated in at least twenty-four apps. This classification was built from three classifications. One focuses on formative assessment techniques and cognitive development goals; another organizes apps by type of pedagogical activities, and finally, another organizes, not apps, but web tools for cognitive development goals to an outdated version.

The built classification, called *New App Classification Model for Formative Assessment*, takes on a practical dimension given the ease of choosing the formative assessment technique, according to the objective of cognitive development, with the guarantee of obtaining feedback from the formative assessment and the respective digital record.

The New Model of Classification of Apps for Formative Assessment was subject to a survey of gaps in order to achieve a more complete model. It was identified, for reasons transcending its own construction, the lack of indication of apps for certain cognitive development goals, in the national guidelines for their use - Manual of apps for mobile devices and in the Educational Technologies and Resources Team (ERTE).

The research question is - To what extent will it be possible to create a New App Rating Model for formative assessment?

In the current teaching and learning context, Spector et al. [1] highlight that Ecclestone (2010) argued that formative assessment or the assessment for learning is now considered an integral component of good teaching, of the students' motivation, of their engagement and their consequent higher levels of realization. Spector et al. [1] add that this vision has been supported by many other authors such as Johnson et al. (2016), Narciss (2008) Spector (2015), Woolf (2010). Additionally, timely and informative feedback is recognized as an element capable of improving and accelerating learning (Bransford, Brown, & Cocking, 2000; Clariana, 1990); Epstein et al., 2002; Hannafin, 1982; Kluger & Denisi, 1996; Narciss, 2008)

The above-mentioned certainties regarding the added value of formative assessment's implementation combined with some of the new trends and directions for training evaluations based on advanced technology frame the issue of investigation in an optimistic scenario.

Based on a UNESCO report [2] regarding the future of mobile learning, with goals for 2030, it is understood that the fast-technological advancement propagates waves of change in various education dimensions, relevant to the assessment and, more specifically, regarding formative assessment. The ideal would be for technology and education to evolve alongside educational needs.

2 METHODOLOGY

The methodology adopted is qualitative. This, in this study, becomes very specific because it integrates the construction of an experiment - a new model for classifying apps for formative assessment. This product comes from the analysis of various classifications, both from formative assessment and apps. From the identification of the gaps or limitations of each of the classifications, it was possible to achieve this product.

The observation of day-to-day life is the starting point, so the observation was directed to the contradictions or incongruities of day-to-day life, emerging from the reality surrounding the formative assessment. Directed, more specifically, to the difficulties of rooting the formative assessment, in a reality tended to involve a summative assessment, this reality, by contrast, is legally regulated for an essentially formative assessment [3]. This incongruence has been going on for a long time, since 1992, when the formative assessment is legally defined in a more notorious way in Normative Order nº 98 / A / 92.

The collection of documentary data allowed obtaining information about this social phenomenon and allowed the definition of the research question, we can, therefore, consider that the question is an emerging one. The most relevant documentary data are recorded below:

Spector et al. [1] one of the main limitations of formative assessment is the difficulty in collecting learning interaction data and results and also the analysis of formative feedback and assessment.

F. Tsai, C. Tsai and Lin [4] for formative assessment, individualized online learning is crucial, because the feedback provided by formative online assessment is immediate and because the computer allows students to self-assess and improve immediately.

Also from the day-to-day observation there was another incongruity: the fact that, on the one hand, the most popular apps do not include problem solving and other complex learning; and, on the other hand, the fact that the Technical Report of the Student Profile - skills for the 21st century, undervalue knowledge and value metacognitive knowledge and metacompetence. For Ferraz and Belhot [5] meta-knowledge is equivalent knowledge: to the knowledge used to solve problems and / or choose the best method, theory or structure; strategic knowledge; to self-knowledge.

In order to understand this phenomenon, we proceeded to collect data, applying the artifact analysis technique, since the sources are of a documentary nature.

We highlight some relevant data:

De Spector et al. [1] given the history of emphasis on formative assessment and the potential of new technologies to extend formative assessment in complex problem solving domains, the potential for a greater impact of formative assessment on the development of competencies with regard to learning higher order is high.

From Bhagat and Spector [6] there is not enough research on formative assessment to support learning by simple tasks, with results focused on simple concepts and procedures. The explosion of new technologies makes this support increasingly effective. What needs further understanding is the best way to support the learning of complex and poorly structured tasks and the best way to use the new technologies.

3 RESULTS

The construction of the New App Classification Model for Formative Assessment was carried out in three stages. First, the formative evaluation classifications were found in the light of the revised Bloom taxonomy, followed by the merger of two classifications of digital tools and, finally, the two new classifications were crossed into one.

3.1 Tools for Formative Assessment

In the first stage, the fifty formative assessment techniques of Lopes & Silva [7] and the three formative assessment instruments of Pinto & Santos [8] were found, framed in the circle of Portuguese literature with the instruments within the scope of literature International. In this selection, exclusion criteria were applied, an ethical criterion is emphasized that excludes formative assessment techniques that imply excessive exposure of the student, as it may bring more inhibition to sharing than the necessary ease. This criterion corroborates the perspective of Pinto & Santos [8]:

Evaluation as an ethical issue. The de facto assessment is not a “cold technique”, but an integral part of the communications network that is established between the different actors. Thus, it is legitimate to ask what is the meaning of this practice in the context of the pedagogical relationship: at the service of students or of discrimination between those who know and those who do not know? Leave students to their own devices or sustain everyone's learning?

The classifications and lists used, circumscribed in international literature, were those of the following authors: Dodge [9] and Keeley [10]. The last author stands out for gathering seventy-five formative assessment techniques, which are in line with the principles she defends. From the intersection of the various instruments of formative assessment of the national and international research circle of the aforementioned authors, the inclusion of other instruments by other authors, equally relevant, is added. The instruments are as follows: Exit Cards - Patka et al. [11]; Portfolios - Karlin et al. [12]; Think-Pair-Share, Pass the Question, Muddiest Point, Two-tier Multiple-Choice Questions, Student generated test questions, Concept Card Mapping – Cullinane [13].

The formative assessment instruments of the new list were grouped following, in a first phase, the categorization presented by Dodge [9]. The categorization of this author groups the techniques into four groups: Abstracts and Reflections; Lists, charts and graphic organizers; Visual representations of information; Collaborative activities. In a second phase, there was a need to add two categories: Facts and Concepts and Creation and to rearrange it. Thus, in the new classification, the categories are positioned as follows: Facts and Concepts; Lists, Charts and Graphic Organizers; Abstracts and Reflections; Visual Representations of Information; Collaborative activities; Creation. We call attention to the change of position of the categories Lists, graphics and graphic organizers and Summaries and Reflections, as we understand that there is an inversion of the degree of complexity.

This reconstruction was carried out in the light of Keeley's classification [10] and the revised Bloom Taxonomy [16], given the proximity of both, more evident in the three principles that support it, these approach the four levels of the Knowledge Dimension of Bloom: factual, conceptual, procedural and metacognitive. The four categories of Keeley's classification, in some way, also express the six levels of Bloom's Cognitive Process Dimension: Remember, Understand, Apply, Analyse, Evaluate and Create. Analysing Keeley's first two principles, in the first one we identified that it is a principle centered on factual knowledge, which corresponds to level one of Bloom's taxonomy - Remember. The second focuses on factual, conceptual knowledge and the interconnection of concepts, making reference to understanding and application. Therefore, we can understand that levels two and three - Understand and Apply, of the same taxonomy are underlying. Finally, the Summaries and Reflections category corresponds to levels four and five - Analyse and Evaluate and the category Lists, Graphs and Graphic Organizers corresponds to levels two and three - Understand and Apply.

The third principle is based on metacognition. This principle corresponds to the categories of Abstracts and Reflections, Visual Representations of Information and Creation in the perspective of Bloom's Dimension of Knowledge. In turn, from the perspective of the Dimension of the Cognitive Process, the

categories Summaries and Reflections correspond to levels four and five: Analyse and Evaluate and the categories Visual Representations of Information and Creation are linked to levels five and six: Evaluate and Create.

The absence of direct correspondence from the Collaborative Activities category in this classification is highlighted to the revised Bloom classification. Its presence, however, is relevant given that its primary purpose is the development of communication skills. This fits into the holistic typology of advanced competence by Deist & Winterton (2005), which combines knowledge, skills and social competencies, contained in the Technical Report of the Student Profile - competences for the 21st century [5]. Thus, we can conclude that Collaborative Activities correspond to Social Competence, which includes behaviors and attitudes.

Table 1. New Classification Model of Formative Assessment Tools.

Bloom's Taxonomy (2001)	***Classification of tools for Formative Assessment***	***Formative Assessment Techniques***	
Remember, Understand	*Facts and Concepts.*	• Constructive minitests Two-Tier Multiple Choice Questions • Fist to Five • Filling the gaps in a text - Cloze technique.	
Understand and Apply	*Lists, Graphs and Graphic Organizers*	• Ordered Lines • Graphic Organizers Concept Card Mapping	
Analyze and Assess/Evaluate	*Summaries and Reflections*	• Muddiest Point, Minute Paper • POMS - Point of Most Significance • Bilhetes à entrada e bilhetes à saída, Dry-Erase Boards • Exit Cards • Questionnaires and asking questions in the classroom Student generated test questions • Make questions and mix answers • A&D Statements • Chain notes - Pass the question	• Doubts-taking Day • Three-Minute Pause, Three-Two-One • K-W-L Variations • First Word - Last Word • Peer-led reciprocal questioning • Fact First Questioning • Reunião individual • Look back • Give Me Five • Written report • Two-phase assessment
Create	*Visual representation of information*	• Annotated Student Drawings • In few words or the most summarized possible, S-O-S Summary	
-	*Collaborative Activities*	• Four Corners • Think-Pair-Share • Graffiti Wall • Two Stars and a Wish	• Agreement Circles • Fishbowl Think Aloud • Numbered Heads Together
Assess and Create	*Active creation*	• Portfolio • Thinking log	

3.2 Digital Tools for Formative Assessment

In the second stage, the focus was on two classifications of digital tools, that of Carvalho et al. [14] and Peres e Pimenta [15].

Carvalho et al. [14] list a wide range of mobile applications (apps), to be integrated into the diversity of tasks in teaching and learning contexts by students, teachers, trainers and librarians. The apps were grouped into the following categories: Probe and Test, Represent Knowledge and Challenge to Learn. Peres and Pimenta [15] focus on web tools and analyse cognitive objectives, Soft skills, pedagogical techniques and assessment questions in an articulated way. And yet, they provide structured information in terms of objectives, pedagogical techniques and technological tools. In a comparative analysis between these classifications, it is recognized, in the classification of Carvalho et al. [14], a lower degree of complexity, because basically only three levels are defined. In this, too, there is no mention of the existence of a hierarchical order between the categories, but rather a complementarity between them.

The classification of Peres & Pimenta [15] is quite complete and complex, but it fails to remain as current. Three aspects distance it from the present reality: cognitive objectives, Soft Skills and Web tools. Cognitive objectives - the first aspect, adopted come from the 1956 Bloom taxonomy, prior to the magazine in 2001. The National Education Council [5] referring to Anderson et al. (2001), it is added that the revised taxonomy, unlike the original, presents a hierarchy that is not cumulative, so there may be the overlap of some categories. Ferraz & Belhot [16] with reference to Anderson et al. (2001), explain the two-dimensional character - Knowledge Dimension and Dimension of Cognitive Processes that the taxonomy gained, as well as refer that the Knowledge Dimension started to have another subcategory - metacognition. The authors highlight that this subcategory has become increasingly important, since it enables self-learning and learning control. They consider that this autonomy must be, more and more, conscious and subject to measurement, with the support of communication technology in education. The Dimension of the Cognitive Process can be understood as the means by which knowledge is acquired or built and used to solve daily and eventual problems. This understanding gave rise to the suppression of one subcategory and the integration of another - Creating, is the subcategory with the highest degree of complexity.

The second aspect that makes this classification less current is the integration of Soft Skills. Therefore, the nine Soft Skills used in the classification, defined in 2006, gave rise to others more adjusted to the current reality, in 2018. The Council of the European Union adopted the Council Recommendation of 22 May 2018 on the Essential Competences for the Lifelong Learning, taking into account various data and documents, among the numerous fundamentals that justify the recommendation, we highlight three: the recommendation on the essential skills for lifelong learning in 2006 (3); today's skills (4); the results of international surveys (5). The third aspect, regarding web tools, what happens with this software is that the links gave way to the designated app icons, with the emergence of the use of mobile devices.

There is no doubt about the relevant value of the classification by Peres & Pimenta [15] as to its structure and the respective rationale, therefore, we adopted this classification, however it was adjusted in order to guarantee a greater update. In terms of content, we chose the classification by Carvalho et al. [14], for this purpose, correspondence between the sites and the apps was established, which was mostly achieved, with the exception of apps that do not have their equivalents, which are: Floorplanner, My Heritage and Music Maker JAM.

In selecting the apps for the new classification, exclusion criteria were followed. The first criterion is that of free of charge, the second is related to the existence of apps on the Web and operating systems such as Android and iOS or their existence on Android devices or their existence on the Web and the iOS system. The third criterion corresponds to: apps for intuitive use to be used by students, the fourth favors apps that, due to their functions, allow to obtain more attractive and effective products for learning. The merger of the two classifications in the light of Bloom's Taxonomy [16] generated some correspondence gaps, particularly evident with the suppression of the Synthesis category and the insertion of the Create category of the revised Bloom taxonomy. What differentiates one category from another is, of course, the second dimension Knowledge, the highest level - metacognition. This subcategory did not exist in the past.

Metacognitive Knowledge: related to the recognition of cognition in general and awareness of the breadth and depth of knowledge acquired from a given content. In contrast to procedural knowledge, this knowledge is related to interdisciplinarity. The main idea is to use previously assimilated (interdisciplinary) knowledge to solve problems and / or choose the best method, theory or structure. Strategic knowledge; Knowledge about cognitive activities including preferred contexts and learning situations (styles); and Self-knowledge.

Therefore, based on this description and the research carried out, we recognize the lack of apps aimed at solving problems and / or choosing the best method, theory or structure, mobilizing various

knowledge, such as: previous interdisciplinary knowledge, strategic knowledge, knowledge about cognitive activities and self-knowledge.

3.3 New App Classification Model for Formative Assessment

The New App Classification Model for Formative Assessment is a proposal to find a correspondence between the characteristics and purposes of the tools and / or techniques of formative assessment, and the potentialities and functionalities of applications for mobile devices, in an intrinsic link to Taxonomy Bloom [16].

Table 2. New Classification Model of Formative Assessment Tools.

Bloom's Taxonomy (2001)	***Classification of Formative Assessment Tools***	***Formative assessment techniques***	***Apps and activities***	
Remember, Understand	*Facts and concepts*	● Constructive minitests Two-Tier Multiple Choice Questions ● Fist to Five ● Filling the gaps in a text - Cloze technique.	**Remember – 1D** **Effective/factual – 2D** ● Polls (kahoot) ● Crosswords (no app) ● Lists *(Studyblue)* ● Word Cloud *(Word Cloud)* ● Schedules *(Mindomo)*	● Multiple choice (kahoot and nearpod) ● Graphs (*Mindomo)* ● Research on the internet (no app) ● Definitions *(Kahoot, Nearpod and Studyblue)* ● Recite poems *(Cogi)*
Understand and Apply	*Lists, Graphs and Graphic Organizers*	● Ordered Lines ● Graphic Organizers ● Concept Card Mapping	**Understand – 1D** **Conceptual – 2D** ● Classification of elements (*Mindomo*, *Studyblue)* ● Multiple choice, selection of the set's elements *(Kahoot* e *Nearpod*) ● Illustration of the main idea (*Lensoo Create)* ● Abstract (no app) ● Summary (no app) ● Story's sequence (*Mindomo*) ● Retell a story *(Cogi)* ● Meanings' exemplification (*Studyblue)*	**Apply – 1D** **Conceptual – 2D** ● Diagram, illustrate event/happening/occurenc e (*Mindomo*) ● Conceptual map, regarding a description (*Mindomo*) ● Collection of pictures/photos to demonstrate something (*Powtoon*) ● Book of clippings on studied areas (*Powtoon*) ● Glossary (no app) ● Explanatory video about a built model, translation of a text, dramatization (*Powtoon and Tellagami) (Edmodo)* ● Explanatory video on a specific point demonstrated through pictures. (*Powtoon and Tellagami) (Edmodo)* ● Tutorial that demonstrates the problem's resolution. (*Lensoo Create)*
Analyze and Assess/ Evaluate	*Summaries and Reflections*	● Muddiest Point, Minute Paper ● POMS - Point of Most Significance ● Entrance and Exit Tickets, Dry-Erase Boards	**Analyze – 1D** **Conceptual, Procedural and Metacognitive – 2D** ● Multiple choice, find the problem's solution *(Kahoot and Nearpod)*	**Assess – 1D*** **Procedural and Metacognitive – 2D** ● Aspects that need to be changed and post it on a platform (no app)

		● Exit Cards ● Question Generating ● Make questions and mix answers ● A&D Statements ● Chain notes - Pass the question ● Doubts-taking Day ● Three Minute Pause, Three-Two-One ● K-W-L Variations ● First Word - Last Word ● Peer-led reciprocal questioning ● Fact First Questioning ● Informal Student Interviews ● Look back ● Give Me Five ● Written report ● Two-phase assessment	● Family tree (*Heritage*) ● Biography (no app) ● Analyze artwork, a video, or a data model and register *(ImageChef, Lensoo Create)* ● Investigate to produce information and register (no app) ● Elaborate questionnaires *(Kahoot e Nearpod)* ● Flowchart, critical phases deduced from the description (*Mindomo*) ● Graph, differentiate the information gathered (*Mindomo*)	● Book recommendations (no app) ● Evaluate through criteria and post on a platform (no app) ● Criticism of colleagues' work (sem app) ● Opinion on a topic, in a debate (*Edmodo)* ● Convince your colleagues of something in a conference (no app) ● Panel to discuss points of view (no app) ● Impersonate a character and discuss various topics from their point of view (no app)
Create	*Visual representation of information*	● Annotated Student Drawings ● In few words or the most summarized possible, S-O-S Summary	**Create – 1D*** **Procedural and Metacognitive – 2D** ● Write a story (*Calaméo*) ● Create a TV show, game, puppet theater, dramatization, music, or mime and register (*no app*) ● Marketing campaign plan (no app) ● Solving a real problem (no app) ● Create a machine, draw it and share it (no app) ● Plan of a space (Floorplanner) ● New product, its creation, and share your image (ImageChef, Lensoo Create) ● Ad (Powtoon and Tellagami) ● Cover a book, magazine, ... (no app) ● Compose a rhythm (no app)	
-	*Collaborative Activities*	● Four Corners ● Think-Pair-Share ● Galeria/Parede de Graffiti ● Two Stars and a Wish ● Agreement Circles ● Fishbowl Think Aloud ● Numbered Heads Together		
Assess and Create	*Active creation*	Portfolio Thinking log	**Create – 1D*** **Procedural and Metacognitive – 2D**	

			• Write a story (*Calaméo*) • Create a TV show, game, puppet theater, dramatization, music, or mime and register (*no app*) • Marketing campaign plan (no app) • Solving a real problem (no app) • Create a machine, draw it and share it (no app) • Plan of a space (Floorplanner) • New product, its creation, and share your image (ImageChef, Lensoo Create) • Ad (Powtoon and Tellagami) • Cover a book, magazine, ... (no app) • Compose a rhythm (no app)

In this New App Classification Model for Formative Assessment, gaps were identified, highlighted in table No. XX, in the App and activities column, as activities without an app. In an attempt to close these gaps, the various digital platforms indicated by the Ministry of Education and Science of Portugal were included in the research, under the responsibility of the Educational Technologies and Resources Team (ERTE). More specifically, we try, above all, to identify the real potential of educational resources with regard to the effective support given to students in the development of metacognition, that is, the development of critical thinking and problem-solving skills. However, no app or digital platform has been identified that would satisfy the gaps in our model. We draw attention to the fact that the Apps for Good and EduScratch projects assume that their problem-solving functions, apparently, seem, therefore, to satisfy one of the gaps of our model. However, both are mainly focused on building apps.

Our conclusion regarding the absence of apps that help the student, for example, in the construction of a project or a criticism or a marketing campaign plan, corresponds to the conclusion, presented in section two, by Bhagat & Spector [6], who recognize that what needs more understanding is the best way to support the learning of complex and poorly structured tasks and the best way to use the new technologies.

4 CONCLUSIONS

The conclusions, first, are found in the answer to the research sub-question: To what extent will it be possible to create a new app classification model for formative assessment?

It is possible and has been built a new model for classifying apps for formative assessment, with a view to facilitating the implementation of this assessment combined with the use of apps. From a critical look at the various classifications of TAF and digital tools we find their strengths and weaknesses, in the light of the current Student Profile - 21st century skills. Subsequently, we moved on to the construction of the new, more objective, complete and versatile model. However, this new model presents a gap attributed to reasons that transcend its construction. This gap is due to the fact that no apps capable of supporting the development of higher order learning have been identified, or complex learning or apps that can assist the development of the objectives proposed for the last category - Evaluate and Create.

This gap and the difficulty in overcoming it is also felt by Bhagat and Spector [6] with a warning left about what needs further understanding: it is the best way to support the learning of complex and poorly structured tasks and the best way to use the new technologies.

Finally, the final conclusions correspond to the answer given to the research question - at the level of material resources: Does the school environment have material, human resources and attitudes that promote the use of formative assessment and apps?

The school environment will have to evolve in terms of material resources. The development perspectives broken by the development of this dissertation consist in the improvement of the existing apps in order to allow a greater help of formative evaluation, by mitigating its greatest limitations. As a result of the possible improvement of the apps, the prospects for achieving more frequent use of the apps and TAFs are more freely extended, that is, without the need for access to the publishers' software, paid for, as well as the achievement of a new app classification model for formative assessment, more complete.

ACKNOWLEDGEMENTS

This work is funded by CIEd – _Research Centre on Education, Institute of Education, University of Minho, projects UIDB/01661/2020 and UIDP/01661/2020, through national funds of FCT/MCTES-PT

REFERENCES

[1] J. Spector et al., “Technology Enhanced Formative Assessment for 21st Century Learning”, *Researchgate*, pp.60, 2016. https://www.researchgate.net/publication/305161696_Technology_Enhanced_Formative_Assessment_for_21st_Century_Learning

[2] C. Shuler, N. Winters & M. West, “The Future of mobile learning: implications for policy makers and planners”, pp. 24, 2014. http://www.unesco.org/new/pt/brasilia/about-this-office/single-view/news/o_futuro_da_aprendizagem_movel_implicacoes_para_planejad/

[3] Decree-law no. 17/2016, April 4. (s.d.).

[4] F. H. Tsai, C. C. Tsai, K. Yi Lin, “The evaluation of different gaming modes and feedback types on game-based formative assessment in an online learning environment”, *Elsevier*, pp. 260, 2014. https://scholar.lib.ntnu.edu.tw/en/publications/the-evaluation-of-different-gaming-modes-and-feedback-types-on-ga

[5] E. Faria, I. Rodrigues & R. Perdi, “Student Profile, Skills for the 21st Century, Technical Report”, pp. 9, 2017. http://www.cnedu.pt/pt/publicacoes/estudos-e-relatorios/outros/1231-relatorio-tecnico-perfil-do-aluno-competencias-para-o-seculo-xxi

[6] K. Bhagat & J. Spector, “Formative Assessment in Complex Problem-Solving Domains: The Emerging Role of Assessment Technologies.”, *Journal of Educational Technology & Society*, pp. 312, 2017. https://eds.a.ebscohost.com/eds/detail/detail?vid=0&sid=c2873331-6f2e-4274-b25f-fa7d1ef44e4e%40sessionmgr4007&bdata=JkF1dGhUeXBlPWlwLGNvb2tpZSxzaGliLHVpZCZsYW5nPXB0LWJyJnNpdGU9ZWRzLWxpdmUmc2NvcGU9c2l0ZQ%3d%3d#AN=125829922&db=a9h

[7] J. Lopes & H. Silva, *50 Técnicas de Avalição Formativa.* Lisboa: Lidel, 2015.

[8] J. Pinto & L. Santos, *Modelos de Avaliação das Aprendizagens.* Lisboa: Universidade Aberta, 2006.

[9] J. Dodge, “25 Quick Formative assessment for a differentiated classroom”. New York: Scholastic, 2009.

[10] P. Keeley, In Science Formative Assessment: 75 Practical Strategies for Linking Assessment, Instruction, and Learning, 2st edition. California: SAGE publications, 2016.

[11] Patka et al., “Exit cards: creating a dialogue for continuous evaluation”, *Teaching in Higher Education*, vol. 21, no.6, pp. 659-668, 2016. https://www.tandfonline.com/doi/abs/10.1080/13562517.2016.1167033?scroll=top&needAccess=true&journalCode=cthe20

[12] Karlin et al., “The Practical Application of e-Portfolios in K-12 Classrooms: An Exploration of Three Web 2.0 Tools by Three Teachers”, 2016. https://www.researchgate.net/publication/301623921_The_Practical_Application_of_e-Portfolios_in_K-12_Classrooms_An_Exploration_of_Three_Web_20_Tools_by_Three_Teachers

[13] A. Cullinane, “Formative Assessment Classroom Techniques. Resource & Research Guides”, *Researchgate*, vol. 2, no. 13, 2011. https://www.researchgate.net/publication/283328368_Formative_Assessment_Classroom_Techniques

[14] A. Carvalho & et al. “Apps para dispositivos móveis: manual para professores, formadores e bibliotecários”, *Portuguese Education Ministry, Directorate-General for Education*, 2015. https://estudogeral.sib.uc.pt/bitstream/10316/31202/1/Apps%20dispositivos%20moveis%20-%20manual%20para%20professores%2C%20formadores%20e%20bibliotecários.pdf

[15] P. Peres & P. Pimenta, *Teorias e práticas de B-Learning, 2ª edição.* Lisboa: Sílabo, 2016.

[16] Ferraz, & Belhot., “Bloom Taxonomy: Theoretical review and presentation of the adequacies of the instrument for the definition of instructional objectives”. *Scielo*, pp.-pp. 425-428, 2010. http://www.scielo.br/pdf/gp/v17n2/a15v17n2.pdf