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Science Awareness: Analysis of Moroccan Curriculum Framework for Preschool Education

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Abstract: Morocco has undergone significant reforms in the education and training field, including the implementation of preschool education as a compulsory stage in the education system. Several studies have shown that attitudes toward science tend to decline between the ages of 11 and 14. Therefore, it is crucial to promote the acquisition of different modes of reasoning and forms of thought from early childhood. The primary objective of preschool education in Morocco should be to promote positive attitudes toward science. This study aims to analyze the preschool program prescribed in the Moroccan curriculum framework with regard to scientific awareness as well as its methodological and practical implications. The analysis was conducted using a designed grid and including the following criteria: construction of school science; axiological and psychological foundations of science learning; objectives and competencies; contents; approaches; activities; teaching strategies; didactic resources; pedagogical design and evaluation. The study's findings revealed that the Moroccan Curriculum Framework for Preschool Education featured a number of dimensions related directly to scientific awareness. However, no explicit statements about scientific awareness or science literacy were made. Moreover, some elements suggested in the program document were out of phase with the current trends of scientific awareness. Therefore, the study offered some suggestions for improving the proposal provided by this pedagogical document. In conclusion, Morocco's focus on preschool education is a positive step towards building a more scientifically literate society. However, to fully benefit from it, the guidance document must be revised to reflect current scientific awareness trends.

Keywords: *Curricular framework, early childhood, Morocco, pre-school education, scientific awareness.*

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Introduction

Over the past decade, human capital promotion as a major lever for the success of the New Development Model (NDM) has assumed a prominent position in Morocco's public policies. To achieve this transformation, high-quality education for all has been recognized as a strategic vector on par with the economy, agriculture, tourism, and health. This strategic orientation was clearly articulated by the Special Commission on the Development Model (SCDM) in its report presented to His Majesty King Mohamed VI in May 2021: *"Without a deep transformation of the education system, none of Morocco's development objectives can be achieved in terms of citizen fulfillment, social cohesion, economic growth, and territorial inclusion"* (SCDM, 2021).

Education is widely acknowledged as a crucial determinant of sustainable development and economic growth for any nation. This particular attention paid to the Moroccan school reflects a concerted effort to make it a crucible environment for the training of young people who will shape the future of Morocco. The focus must be on developing in them a sense of autonomy and responsibility, an ethic imbued with humanistic values, open-mindedness, and a capacity for adaptation in a world of perpetual change (SCDM, 2021). This underscores the critical importance of education in the larger context of social and economic development and highlights the need for ongoing investment and reform to ensure that the Moroccan education system remains relevant, effective, and responsive to the evolving needs of society.

The concretization of this strategic orientation has entailed a significant investment by the state in early learning, beginning with the universalization of preschool education (PSE), which has been identified as an inescapable challenge for development by the National Initiative for Human Development (NIHD, 2019). Furthermore, the 2015-2030 educational reform strategic vision emphasizes the importance of PSE as a foundational component of any efforts to promote equity, quality, and reduce dropout rates and school failure. As part of the government's program for 2016–

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2021, the goal of achieving 100 percent enrollment of children aged 4–15 by 2030 has been declared. The emphasis on PSE is grounded in a growing body of research that highlights the crucial role of the early years in shaping intellectual, economic, and social capabilities (El Elandaloussi & Faiq, 2008; Fernández & Requena, 2017).

In light of the growing recognition of the critical role of PSE and the need for its generalization, there is a pressing need for a substantial improvement in the quality of pre-school education. A deep modernization of programs and pedagogical approaches is required to align with the competencies of the 21st century, including independent thinking, curiosity, communication, and a cooperative spirit. These competencies are in high demand in today's fast-paced, interconnected world. The best way to develop these necessary skills is to expose children to scientific culture and promote “scientific awareness”.

Scientific awareness (SA) refers to recognizing the importance of science and science education as a pre-requisite to forming positive attitudes towards science and engaging in school science and scientific social issues. It provides a disposition or readiness to gain knowledge, skills, and attitudes that are desired outcomes. It has been demonstrated that scientific education has a positive influence on children's social and moral behavior (Caballero García & Raña, 2018). It helps foster a sense of curiosity in children by allowing them to explore, question, observe, discover, and share their wonders of the world (Howitt et al., 2011) and help them develop scientific concepts as well as preparatory skills for language, literacy, and mathematics (Gerde et al., 2013). Science education is also an effective way to enhance children's lifelong learning, autonomy, and creative thinking skills (El Elandaloussi & Faiq, 2008; Njagi, 2016).

SA is a crucial objective that should be pursued from the earliest years of formal education and reinforced as the child progresses in his or her academic journey (Taoufik et al., 2016). In 2007, the Higher Council of Education, Training, and Scientific Research (HCETSR) recommended the integration of scientific awareness activities, specifically those related to animal and plant biology and technology, into preschool education using the scientific method as a pedagogical approach. Despite this call to action, the implementation of SA in preschool education in Morocco remains a challenge. The multiplicity of supervisory bodies, structures, and practices, the majority of educators lacking specialized initial training, the novelty of the preschool concept in Moroccan society, and the absence of a unified curricular framework present significant obstacles to the realization of this objective (Faiq, 2012).

In order to address the aforementioned difficulties, it is crucial to implement a specific educational framework that is structured and unified in its objectives while also being diverse in its style and methodologies. This framework should be rooted in the country's social and cultural context, and it should take into account the preschool level's unique aspects within the broader education and training system. This approach, as stated by the HCETSR, will allow for the modernization of educational programs, pedagogical techniques, educational materials, and resources. Furthermore, it will ensure the equitable provision of quality services and performance for all preschool-aged children (El Elandaloussi & Faiq, 2008). In this regard, in 2018, the Ministry of National Education, Professional Training, Higher Education, and Scientific Research collaborated with UNICEF to develop a national curricular framework for PSE that serves as a guide for pedagogical instruction. This framework outlines the fundamental requirements for preschool education.

According to a 2016 HCETSR report, developing educational materials that promote scientific literacy at a young age can significantly improve high school students' performance and interest in scientific subjects. A Moroccan study aimed at designing a preschool education curriculum also highlighted the importance of scientific and technological awareness, suggesting that it should be a key area of focus in preschool education. The study recommended introducing children to the scientific approach, the living and inert worlds, and technology to promote science as a field of competence (Faiq, 2012).

Research in science education in Morocco has been focused mainly on students during their middle and high school years. There was less interest in the early childhood education years, which may be fundamental in shaping students’ attitudes towards science and in determining subject choice, given that Moroccan students are among the underachievers in the National Achievement Assessment Program (NAEP), the Trends in International Mathematics and Science Study (TIMSS), and the Program for International Student Assessment (PISA). Morocco scored below the global average and was clustered at the bottom of the table with countries that had much lower levels of per capita income. Therefore, a study conducted by Morgan et al. (2016) found that the science achievement gap begins for most children even before they enter kindergarten. To the best of our knowledge, no previous research has looked into the topic of science awareness in Moroccan preschool education. The purpose of this study is to conduct a critical analysis of the current preschool curriculum framework and assess its positioning and contribution to SA.

Methodology

In order to analyze the official curriculum framework for preschool education (CFPE), a grid was designed with eleven dimensions related to various didactic and epistemological aspects of school science: (a) construction of school science; (b) axiological foundations; (c) psychological foundations; (d) objectives and competencies; (e) contents; (f) approaches and methodology; (g) activities; (h) teaching strategy; (i) didactic resources; (j) pedagogical design; and (k) evaluation.

The grid was adapted from a previous study that analyzed the scientific literacy promoted by Spain's national curriculum for the 3-6 year old stage (García-Carmona et al., 2014). A few modifications were done in the grid to best fit with the context of our study.

Dimensions and guiding questions were identified based on the conclusions of a quantitative study conducted in Spain, with the intention to identify conceptions, difficulties, obstacles and facilitative factors, which influenced the teachers' attempts to introduce inquiry-oriented practices into their classrooms (Pozuelos et al., 2010). Through a detailed review of the literature, proposed responses were developed thought to represent the characteristics singularly attributable to each of the underlying dimensions (Boilevin, 2013; Cañal de León et al., 2013; Fernández & Requena, 2017; Gil et al., 2006; Ministry of National Education [MoNE], 2013).

The purpose is to analyze the content of the CFPE and evaluate its positioning regarding the above-mentioned dimensions and the indicators assigned to them, according to the following scheme:

The aspect is clearly and explicitly mentioned or suggested.

The aspect is implicitly, superficially or incompletely mentioned or suggested.

The aspect is not indicated or mentioned.

Given the interpretative nature of this study, inter- and intra-judge reliability were combined (Padilla-Carmona, 2002). Two researchers on the team agreed on a preliminary version of the analysis grid. A second version was developed after a third researcher on the team reviewed it. With this, the two initial researchers have initially and independently performed a parallel analysis of the document and then pooled their findings. The differences and discrepancies were identified, discussed, and resolved by the third researcher's intervention. This preliminary analysis resulted in an improved and definitive version. Moreover, five months later, one of the researchers performed the same analysis with the final version, obtaining even more significant results than in the preliminary analysis. These latter are presented in this paper.

Results

Construction of Academic Scientific Knowledge:

The CFPE recognizes the importance of the preschool stage in a child's personality development, but it has not made explicit reference to the notion of scientific awareness or activities and their contribution to the shaping of the child's personality.

> *"What makes this stage of development a decisive period for the formation of the child's personality, openness to himself and the world around him, and learning of the fundamental skills required for a better integration in the school world and later in life"* (p. 8)

> *"PE must allow the acquisition of skills and behaviors that promote: the evolution of the personality and its openness to the environment; [...] the ability to evolve and develop"* (p. 11)

Using the child's natural and social environment as a starting point for designing the content to be taught is clearly mentioned in the CFPE.

> *"It is proposed to organize projects [...] taking into account: Adoption of progressiveness: beginning with the self, then the family, and finally the child's immediate environment "* (p. 45)

The CFPE has not demonstrated specific attention to the significance of children's initial conceptions in the process of scientific knowledge construction or how to overcome them. Furthermore, there has been no reference to the description of how preschool science is built.

Axiological Foundations:

The CFPE has engaged with the axiological dimension utilizing the framework of "learning domains" which encompasses a collection of dimensions associated with conceptualization, prediction, categorization, and reasoning.

> *"Competencies related to the discovery of oneself and one's environment: exploration his body to discover, develop and preserve it. Opening up to the outside world to discover and learn the basic rules for interacting with it"* (p. 12)

> *"Competence related to the construction of the basis of mental operations and the organization of thought: Development of mental mechanisms that allow a child to perceive, understand, compare, organize, and interact with surrounding objects"* (p. 12)

> *"Competence related to the development of common life values and rules: development of social and emotional aspects "* (p. 12)

Psychological Foundation:

The Moroccan CFPE has shown a general interest in early childhood learning without mentioning the specificity of science learning, as evidenced by the simple identification of certain properties characterizing the child's personality during this phase.

> *"Early childhood is one of the most important and defining stages of human life since it marks the future development of the personality"* (p. 27)

> *"The engineering design of this curriculum framework has been continuously focused on building a pedagogical identity for preschool education by distinguishing it from the primary cycle [...]."* (p. 11)

> *"[...] given that this cycle of education is one of the main pillars that contribute to the achievement of compulsory education and the development of the desired pedagogical quality [...]."* (p. 15)

The child represents and comprehends the world around him/her through his/her initial conceptions and personal experiences. This idea is clearly presented in the document as follows:

> *"[...] that his relationship with the world is characterized by a tendency to egocentrism that pushes him to see things from his own point of view without being able to perceive the opinion of the other"* (p. 27)

> *"He feels gaps in his knowledge, so he tends to want to fill them"* (p. 30)

The CFPE has explicitly referenced the concept of stimulating a child's innate desire to learn through assigning tasks that are relevant to the child's personal interests and needs:

> *"Taking into account his motivation and needs, should have a special psychological understanding (attention) [...] in every educational activity"* (p. 23)

> *" organize projects, taking into account: [...] compatibility with the child's tendencies and interests, as well as their ability to hold the child's attention and favor his involvement in work and production; Achievement of the spiral progression in the course of learning "* (p. 45)

The document examined recognizes the significance of children's active participation in knowledge construction, which corresponds to an updated view of science education.

> *"Exit profiles of preschool: the acquisition of autonomy and initiative behavior; active participation in learning activities; the ability to evolve and develop"* (p. 33)

> *"The child recognizes rewarding situations: being treated with dignity, feeling appreciated, having the opportunity to play, engaging in motor activities, meeting pressing psychological and educational needs, feeling pleasure, and cultivating senses of endurance."* (p. 24)

The CFPE has underlined the importance of social-emotional skill development as one of the main goals for teaching any subject at this level and has identified it as a critical concern for early childhood education.

> *"In order to promote fundamental learning, it is supposed to be achieved in the areas of psychomotor, cognitive, and socio-emotional development"* (p. 15)

> *"Competence in the development of values and rules of common life: emotional and social development [...]"* (p. 12)

> *"At the social-emotional level, being able to exercise certain behavioral and reactive controls associated with respect for the rules of living together and positive emotional interactions within the community... having positive attitudes toward self, others, and the environment...* (pp. 33-34)

However, the importance of communicative interaction as an integral component of the learning process was not clearly stated in the document; it was merely presented as an exit profile for preschools.

> *"[...] of the exit profiles of preschool learning structures: [...] Flexible interaction with peers and teachers [...]"* (p. 33)

Objectives and Competencies:

The CFPE recognizes the importance of cognitive and language skills. However, no direct link between science awareness and the development of these kinds of skills has been articulated.

> *“Child is expected to begin in the acquisition and development of educational skills that contribute to the development of his personality [...]. He should at the mental and cognitive level: manage primary mental processes (noting, exploring, adjusting, organizing, establishing series, classifying, comparing, asking questions, defining relationships) [...]; Use functional tools of language and communication.”* (p. 33)

> *“Be willing to possess the tools of observation, self-discovery, and environmental and technological space.”* (p. 36)

> *“The best learning is that which begins with exploration.”* (p.36)

> *"In order to learn and construct his learning by himself and with the help of a mediator...the child needs intellectual tools [...] such as distinction, comparison, classification, analysis, synthesis [...]"* (p. 37)

The CFPE affirms the importance of new technologies for integrating preschool education without specifying their use in learning.

> *"Use information and communication techniques in a simple way in the construction of learning"* (pp. 33–34)

Even the CFPE referred to the skill "learning to learn" competency, it did not provide details on how to achieve it pedagogically:

> *"[...] enabling them to acquire abilities that will allow them to be lifelong learners and to be incorporated into primary school activities."*

Contents:

The CFPE endorses the notion of integrating early childhood learning content with the daily experiences and interests of children:

> *"learning projects are organized [...] taking into account [...]; Compatibility with children's tendencies and interests, their potential to hold the child's attention, and to foster his involvement in work and production [...]"* (p. 45)

The CFPS has limited the pedagogical approach to be adopted at the preschool level to play-based learning whatever the expected objective as mentioned:

> *"All work and animation methods should be built on the basis of play and manual work"* (p. 58)

The CFPE has introduced a novel concept called "areas of learning" to categorize various educational activities and refer to learning content.

> *"[...] the concept of "school subject" is replaced by "learning areas" and regular subjects such as [...] mathematics and scientific and artistic awareness activities have been replaced by new designations"* (p. 44)

The CFPE has presented the following vision, which describes the guiding principles for advancing in the process of learning:

> *"It is proposed to organize learning projects [...] taking into account [...]; The adoption of progressiveness [...] The possibility and degree of complementarity required to treat all learning area activities; the realization of the spiral progression, with graduation concerning the kind and quantity-volume of learning [...]"* (p. 45)

> *"The CFPE takes care to combine the unity of personality with the unity of learning act, based on the introduction of educational projects as a mechanism of organization, harmonization, and coherence of activities and targeted learning"* (p. 45)

Approaches /Activities /Pedagogical strategies /Learning resources:

The CFPE provided a general framework for the pedagogical approach employed in preschool, which has been restricted to a play-based learning.

> *"All methods of work and animation should be built on the basis of play and manual work [...] based on observation and concentration of attention"* (p. 58)

> *"The adoption of play as a basis for work [...] individual, binary, small group, collective, in class or outside [...]"* (p. 58)

With regard to the sources of content and teaching resources, CCEPS refers to strategies for selecting starting situations from the real and sensitive world of the children that arouse their curiosity. As for the usual learning space for children, it is often limited to the classroom.

Instructional Design:

The document assigns educators the responsibility of developing lessons to be taught. It promotes the practice of designing lessons based on a specific thematic project, outlining a framework known as "thematic projects." This approach is defined by the CFPE as:

> *"Thematic projects are considered as work spaces in the learning areas; they are considered as an entry point for the realization of a link between personality and the act of learning and to ensure coherence between the activities and the targeted learning"* (p. 12)

> *"Each project is addressed in relation to all areas of learning; [...] the focus is not on the project itself but primarily on what the child learns about a subject"* (p. 13)

Monitoring/Evaluation:

The CFPE referred to the evaluative process by mentioning the following four steps:

"[...] Formulation and refinement of evaluation tools; execution of the evaluation; interpretation of results; and intervention based on the results" (p. 60)

The CFPE recognizes the specificity of monitoring/ evaluation in preschool:

> *"Monitoring and evaluation does not aim to use summative assessment to categorize and compare children and does not lead to a decision regarding their passage to the next level; they are not reserved for educators [...] and can be practiced by the different stakeholders at this level"* (p. 59)
>
> *"monitoring/evaluation are operations that may take place in the structure of the PSE, at home through the means of transportation; Covering various aspects of personality, based on tools and means ...; Monitor and assess behavior, skills and knowledge, but may also extend to analysis, reading /interpretation to communication and interventions that aim to combat dysfunctions"* (p. 59)

The document pointed out that this evaluation operation must also cover the teaching practice, as mentioned in the following expression:

"From the observation and evaluation of the children's behaviors, it is possible to evaluate other components of the curricular system (objectives, activities, methods and techniques, means used... monitoring tools evaluation" (p. 59)

The CFPE makes mention of involving the children themselves in the evaluation process, whether through self-evaluation or in the context of evaluating the pairs:

> *"They are not restricted to educators... ... can be practiced by... child himself, other children"* (p. 59)

Regarding the evaluation tools, the document privileges observation in class:

> *"Observation is the most frequently used method in this case"* (p. 60)

The document proposed a variety of tools and means to which different actors can appeal:

> *"Mental tests, personality tests, sociometric tests to measure social relationships, psychodrama and sociodrama; forms; drawings; interviews [...]"* (p. 60)

The CFPE assigns educators the responsibility of developing diverse tools for assessing student progress.

> *"Educators are empowered to design special tools for monitoring and evaluating children's learning"* (p. 62)

Discussion

Construction of Academic Scientific Knowledge:

According to Paun (2006), academic scientific knowledge must undergo multiple transformations to become an object of teaching. These transformations are part of a rigorous process of didactic transposition, which involves converting scholarly knowledge (the constituted science), understandable only by elite, into school knowledge that is accessible to both students and teachers. A comparison of scientific texts with didactic content reveals visible differences that are primarily imposed by the unique demands of teaching at the school level. The knowledge to be taught at this level is the result of a rigorous selection within the established body of knowledge.

Based on science didactics research, various authors have proposed scientific activities tailored for preschool level education (Brown, 1991; Hackling et al., 2007; Howitt et al., 2011; Samarapungavan et al., 2008). However, it is not a matter of merely selecting or projecting scientific knowledge taught at higher levels but of designing activities that respect the cognitive faculties and interests of children (García-Carmona et al., 2014).

At an elementary level such as preschool, the promotion of formal science education is discouraged. Science in preschool is born from a process of simplification and adaptation of academic science to the life context and psycho-cognitive abilities of the child (García-Carmona et al., 2014). Therefore, it is highly advised to begin by piquing the child's interest and creating a scientific environment that is tailored to their needs. Preschool science instruction should be based on the child's initial conceptions of easily perceptible phenomena (both natural and artificial) and basic scientific concepts in the immediate environment. These initial conceptions are the only tool available to the child to decode situations and messages.

In most cases, the child's conceptions are incorrect, incomplete, or even contradictory to those accepted by science (Giordan, 2008). In order to evolve it progressively and significantly towards adequate school knowledge, it is suggested to accompany the child to become aware of the limits of his conceptions so that he can spontaneously access new knowledge (Cañal de León et al., 2013; Fernández & Requena, 2017; García-Carmona et al., 2014).

The CFPE has not demonstrated specific attention to the significance of children's initial conceptions in the process of scientific knowledge construction or how to overcome them. In addition, it has not alluded on any occasion to the description of school science or to how it is constructed.

The SA should allow the child, having an egocentric tendency and a syncretic worldview, to "decentralize" his subjective point of view in order to incorporate well-founded arguments from others and contributions from experience (Boilevin, 2013). The main objective of SA is to equip children to better understand and interact with the natural and technological worlds around them. SA aims to foster children's curiosity and critical thinking, allowing them to appreciate the various causes and consequences of scientific and technological advancement (García-Carmona et al., 2014).

Despite his young age, the child has conceptualization and logical reasoning abilities (Ledrapier, 2010). This is indeed a good reason to engage in SA at the pre-school stage. The CFPE recognizes the importance of this phase in the formation of the child's personality. However, it has not made explicit reference to the notion of SA or scientific activities or any contribution in this sense.

Axiological Foundations:

A young child's brain is naturally full of potential. The early years are an unreplaceable period for giving him the keys to success in primary school and throughout the rest of his life. Numerous recent studies in cognitive psychology have shown the existence of cognitive faculties (conceptualization, prediction, categorization, and reasoning) in very young children well before the age of kindergarten (Ledrapier, 2010). From a psychological standpoint, the 4-6-year-old stage is an ideal time to introduce young children to scientific culture. It will allow them to develop values, attitudes, and behaviors that will help realize a healthy and sustainable socio-natural environment (Caballero García & Raña, 2018). Indeed, SA activities help children develop relationships with their environment by reminding them that natural resources are finite (Boilevin, 2017). In addition, these activities facilitate the understanding of the main lines of thought that will promote the child's comprehension of the surrounding world in aspects that presuppose dialogic communication, an openness to others, and divergences (Boilevin, 2017).

Through active methods, young children can be introduced to cognitive skills such as decision-making and appreciating the validity of an observation, the accuracy of a description, and the validity of a reasoning in regards to the phenomena studied and the questions raised (Boilevin, 2017; Chafiqi & Tiberghien, 2009). The CFPE has touched on this axiological aspect using the concept of "learning domains," which bring jointly a set of dimensions that we judged to be directly related to the previously mentioned elements.

Psychological Foundations:

The fact of being interested in the question of science education in preschool, with reference to the limited cognitive level of the children, is sometimes makes one smile and seem unserious. The question, on the contrary, is legitimate and relevant by referring to various research on cognitive psychology, which have demonstrated the value of starting learning between the age of three and six, the most sensitive period for learning (Ledrapier, 2010). On the other hand, this polemic question supports the idea of the particularism that distinguishes early childhood science teaching and learning from other disciplines. The Moroccan CFPE has given general attention to preschool learning specificities without mentioning the particularity of science learning.

As previously stated, the child represents and comprehends the world through his initial conceptions. The only way to make him acquire knowledge is to take him where he is, not where the teacher would like him to be. It is from the child's initial ideas and experiences and from his ways of reasoning that teachers should adapt, or at least propose, a more effective pedagogy.

The CFPE's attention to the child's initial experiences and conceptions, as well as their role in the construction of scientific knowledge, seems inadequate. It is not sufficient to limit the focus to tracing a few properties that characterize the child's personality at this level. The fundamental question is how this child will manage to feel by himself these gaps without being accompanied, knowing well that it is a heavy task since it requires a great deal of cognitive restructuring and mental operation.

Initial conceptions are usually entrenched and are sometimes so resistant that they persist into adulthood (Chaoued, 2006). These conceptions should be a catalyst for the evolution of knowledge since they form a break that energizes the progress of knowledge. However, educators often fail to recognize the importance of addressing these misconceptions, so that children acquire only the illusion of knowledge, which slides to the surface (Bachelard, 1993). We therefore believe that the guide should sufficiently address this point to clarify the strategies that educators should adopt given these epistemological barriers.

In addition to the important role of initial conceptions, several authors recognize the importance of the child's natural and social environment as a starting point for designing educational activities. In their opinion, this favors access to meaningful knowledge (Cañal de León et al., 2013; de Villeroy, 2014). The contents conveyed should relate to different aspects of the child's daily life. It should also be interesting and motivating (Cañal de León et al., 2013).

To stimulate a child's desire to learn, encourage active participation in learning, and stimulate curiosity to explore and understand the environment, the tasks proposed must be interesting and relevant to the child's interests (Cañal de León et al., 2013; Dewey, 1995; Severine, 2006). This requires the educator to be attentive to the needs of the child and his personality as a whole (Severine, 2006). These aspects were explicitly mentioned in the CFPE.

Pedagogues recognize the importance of children's active involvement in knowledge construction (Brown, 1991; Dewey, 1995; Fernández & Requena, 2017). The learning process must place the learners in an active situation and enable them to make sense of what they are learning. This is only possible through a reassuring and safe atmosphere, an appropriate relationship with adults, educational materials that meet the child's needs, and opportunities to take risks without fear of failure. This helps children build self-confidence and assume an appropriate degree of autonomy, initiative, and responsibility in their learning (Brown, 1991; Njagi, 2016; Severine, 2006). The analyzed document is in line with this updated vision of science didactics.

Among the main goals of preschool education, the CFPE highlighted the development of social-emotional skills as an essential issue for the learning of any subject. However, the document did not express explicitly the importance of communicative interaction with inside the learning process. Even though it refers to the need to introduce children to the use of functional tools of language and communication, it does not justify its pedagogical interest. According to the document, this will only be of interest to prepare the child for reading and writing.

It also does not refer to the importance of the interactive dimension in learning in general nor to the role that science teaching at a young age can have in the social and emotional development of children (García-Carmona et al., 2014). The CFPE had not given this issue enough attention by failing to explain its pedagogical contributions and how to foster it in the classroom. This dimension is only presented as an exit profile of preschool learning structures.

Several authors in the field of cognitive developmental psychology, such as Vygotsky, Bruner, and others, have emphasized the importance of social interaction in the cognitive development of the individual. Exchanges, socio-cognitive conflict, and the confrontation of ideas engage the process of knowledge construction (Bruner, 1983; Cañal de León et al., 2013; Giordan, 2008). These are foundations that support the intention to elicit inquiry and consider students' conceptions (Couture, 2005; Giordan, 2008). Those two elements did not appear in any way in the document.

Socio-constructivism seems to be the most suitable approach for promoting SA at the preschool level (Bächtold, 2012; Fernández & Requena, 2017). It suggests building knowledge on a cognitive similarity plane and encourages cooperative learning. The learning will be conceived as a set of conclusions reached collectively after having observed, discussed, asked questions, planned, experienced, analyzed, verified, and evaluated possible explanations of the addressed issues (Fernández & Requena, 2017). As a result, it particularly helps children in difficulties and enriches those who are more advanced.

Objectives and Competencies:

Didacticians recognize that the development of cognitive and language skills should be one of the priority objectives of basic education. A major concern is ensuring that children acquire a scientific culture that enables them to function satisfactorily in a society steeped in science and technology (Gerde et al., 2013). The French ministry of national education (MEN), for example, has adopted those ideas for its project to promote pre-scholar education (MoNE, 2013). Introducing children to the scientific culture and the inquiry process allows them, in addition to acquiring socio-emotional skills, to integrate a systematic model that makes them participate in observation, questioning, prediction, experimentation, synthesis, and sharing of results (Gerde et al., 2013). Furthermore, their involvement in science awareness activities allows them to build common references for empirical knowledge as well as for reasoning forms and related language practices (Ledrapier, 2010). Although the CFPE recognizes these dimensions, no direct link has been articulated between science awareness and the development of these kinds of skills.

The skill of "learning to learn" is always neglected, while it is advisable to promote it from preschool onward (Elandaloussi & Faiq, 2007; Faiq, 2012). The CFPE has mentioned this component. However, there are no details on how to achieve it pedagogically, nor is it defined in what framework of activities or pedagogical approaches. The answer to this question lies in the inquiry process, which creates in the child a certain autonomy towards knowledge and preserves, throughout life, the desire to learn and seek the information that he needs (El Elandaloussi & Faiq, 2008; Faiq, 2012; Njagi, 2016).

The CFPE has outlined the skills to be developed at the preschool level in a discontinuity and compartmentalization framework. It gives the impression that each skill can be developed independently of the others, whereas, for example, language skills, thinking skills, and social-emotional skills can all be worked on during the same SA activity. It is also worth noting that the CFPE has restricted the cognitive targets of sub-skills in relation to the development of observation and discovery tools to the level of knowing.

Contents:

Educational experts support the idea of linking learning content in preschool to the daily lives and interests of children (Couture, 2005). This is reaffirmed in the CFPE. It is therefore appropriate to question the scope of this vision of science instruction that places the children's questions as the starting point of the approaches to be considered (Couture, 2005). However, the nature of this questioning remains unclear. Is it a matter of starting from the children's spontaneous questions, of proposing questions related to the prescribed knowledge by trying to link them to daily life, or of engaging them in a work of problematization?(Couture, 2005). The CFPE has not paid attention to answering this question since each alternative calls for a completely different approach. It has limited itself to framing the approach to learn by play.

A learning content is a conceptual, procedural, or behavioral tool, scenario, or piece of knowledge used to progressively develop competencies intended for the preschool level (García-Carmona et al., 2014). To accomplish this, the CFPE uses a new concept that it considers being inherent in pre-primary education, especially the so-called “areas of learning” in which various educational activities are organized. Around these learning areas, thematic projects related to aspects of the children's daily lives and their output profiles were proposed.

The document established a coherent relationship between the learning objectives and the proposed contents for the development of an initial scientific culture. However, it does not indicate consistency or how to avoid compartmentalizing the various learning areas suggested. To ensure a balance between the learning related to each area studied, the contents must be conceived in a non-fragmented manner, according to the link that exists between. Moreover, the progression of learning, which defines the logic with which introducing such content across educational stages, is the first criterion for educators to organize their teaching (García-Carmona et al., 2014). Even if the incentive is apparent, its application seems ambiguous. Can truly gradual and coherent progression be achieved simply by applying the spiral model? That means to make less efforts and reflection on the coherence of a discipline to determine its elements, especially the scientific discipline. It seems more important for educators to define the elements they need to start teaching, use them in the next unit, and so on. Logically, such references should be nuanced and refined according to the specifics of each educational context.

A proposal for a procedural progression could be: first, let the children learn to systematically observe objects and phenomena of daily life; second, children must learn to verbalize their observations; third, gradually increase the number of observed aspects around the same phenomenon and verbalize what is observed; and fourth, make a first transition from the simple description to the explanation of the observed aspects (García-Carmona et al., 2014).

Approaches / Activities / Pedagogical Strategies / Learning Resources:

Children's questions and interests are not the only starting point for scientific activities. On the one hand, they cannot imagine all the relevant problems provided by the official program. On the other hand, the educator's programs cannot be permanently changed to respond to every kind of problem raised by a child. Therefore, it seems insufficient to link the contents to daily life and to the children's questions. As for motivation and interest in learning, as role, these are developed in the act of learning itself by arousing that interest through the engagement of children in inquiry process, of problematization, and construction of scientific knowledge (Couture, 2005).

Educators should invest in creating learning situations and implementing the necessary materials. This allows children to reflect on a particular topic or phenomenon individually or in small groups, confronting their own thoughts and highlighting differences of opinion. This creates a dynamic in the classroom where all children are involved in the problem and disagreements are a source of motivation.

In the context of SA, the approach to be considered is inquiry-based learning (IBL). It is a hypothetical-deductive process that calls for questioning and the construction of knowledge (Pedaste et al., 2015). After the problematization phase, where the subject is introduced by the educator or defined by children and their curiosity, the conceptualization phase begins, based on the formulation of the research question and the generation of hypotheses. This phase consists of designing a practical activity, exploring, applying established protocols, and interpreting results related to creating meaning from previously collected data. After this, children return to their research question or hypothesis and draw their own conclusions. The IBL process ends with a discussion phase where the children share their findings and accept feedback, giving each an opportunity to meta-cognitively reflect on the process (Pedaste et al., 2015). The CFPE has simply provided a general framework for the pedagogy adopted in preschool education. In other words, it is a play-based approach, what so ever the activity or the pedagogical objective. Defining the notion of play can be difficult. The document did not pay attention to defining play-based methods or to suggesting guiding criteria that help establish logical sequences of play activities.

The document mentioned the discovery, observation, conceptualization, and reinvestment activities recognized as phases of the IBL approach but omitted the essential elements of this process. These elements are, for example, the highlighting of initial conceptions, the formulation of the problems, the participation of the children in this formulation and in the elaboration of the research protocol, the planning of the inquiry, the selection, recording, and confrontation of ideas, and the sharing of conclusions... This calls into question the positioning of the document in relation to the inquiry process and its role in overcoming epistemological obstacles, especially when it comes to SA activities. Therefore, greater attention needs to be given to the description of the predefined ludic approach and the way in which it can be envisaged in order to adequately respond to learning objectives and to avoid any ambiguity for the educator in this concern.

In terms of content sources and didactic resources, the CFPE refers to strategies for selecting starting situations from children's real and sensitive world that arouse their curiosity. However, the usual learning space for children will be the classroom; it would be good then to suggest specific resources and strategies to promote scientific culture in this context. It is appropriate to propose science experiment corners and workshops in the classroom. Equip preschool structures with didactic materials, including manipulative materials, to support the conduct of SA activities. Moreover, it turns out that extracurricular programs should be encouraged. Through conventions set up with various educational partners, children are empowered to open up to their environment. This includes, but is not necessarily limited to, ecological centers and museums.

The document proposes to initiate the use of new information and communication technologies (ICT) for education as a means to support learning. Likewise, the provision of an adequate supply of stimulating and pedagogical equipment must be considered while proposing pre-school pedagogical kits for each class.

Instructional Design:

The CFPE encourages educators to suggest lessons to be taught according to a given thematic project. It proposes a framework labeled "thematic projects". When it comes to scientific activities, it is primarily the responsibility of teachers to design didactic proposals adapted to a given educational context. However, in practice, this competence is delegated to various publishers. They are often the ones who determine what is taught in the classrooms. This does not depreciate the value of these proposals. However, educators and competent authorities must view them above all as didactic tools that must be subject to critical scrutiny. In fact, the integration of training in science didactics for the benefit of educators is of great interest.

Monitoring/Evaluation:

In order to make judgments about children's targeted skill development in preschool, educators must use the evaluative approach. It is a documented process that provides educators with a foundation for building assessments. The five steps of the process are defined as follows: planning, information gathering, interpretation, judgment and decision, and communication (Roy et al., 2015). The CFPE recognizes the specificity of monitoring and evaluation in preschool. It referred to the evaluative process by mentioning four steps: Formulation and refinement of evaluation tools; execution of the evaluation; interpretation of results; and intervention based on the results. However, there is no explicit mention of the results reporting phase. In fact, this critical stage should follow the judgment and decision phase. It allows educators to communicate results of their observations to the child, his parents and any other person concerned with his progress (administration, educational supervisors, medical and paramedical staff, etc.), through various means, such as portfolio, telephone calls home, parents' meetings and written communications (messages in the agenda, Child's productions with comments, etc.).

Regarding the evaluation tools, the document privileges observation in class under its various aspects, including play participation, observation with tools, devices, and networks. The document proposed, secondarily, *mental tests, personality tests, sociometric tests, psychodrama and sociodrama, forms, drawings, and interviews*. However, all the suggested methods involve an evaluation conducted by outside parties, and none of them provide opportunities for children to actively participate in the assessment. The IBL process considers this dimension and proposes complementary instruments for this engagement: portfolio, checklists, charts, etc. Beyond that, the document did not mention integrating ICT at all. In this process, these tools present an important source of information by accumulating sufficient traces of skills to be developed in the child. For example, using photos of the children's productions and video sequences illustrating their behavior in various activities will ensure effective interpretation and make sense of the collected data.

There is no reference to the concept of evaluation criteria. The document presented a set of rating grids that simply listed the skills developed in PE and provided a scale to represent the level of mastery. Criteria-based assessment allows the collected data to be compared with previously established criteria, increasing the reliability of the assessment process (Roy et al., 2015). Additionally, training educators on the design and use of these tools is of great interest to facilitate their eventual adoption, especially since the document leaves them the responsibility for developing different monitoring and evaluation tools. Training educators on criteria-based assessment will enable them to target skills, essential knowledge, evaluation criteria, and achievement contexts, taking into account the children's interests and developmental rhythms (Roy et al., 2015).

Conclusion

The objective of this study was to assess the preschool Moroccan curricular in term of scientific awareness defined as the acknowledgement of the importance of science and science education as an important pre-requisite to forming positive attitudes towards science and engaging in school science and scientific social issues. Based on the analysis performed, it was concluded that the actual CFPE promotes science awareness, which is consistent with the literature in many aspects (using the child's natural and social environment as a starting point for designing the scientific content; , incitation to propose interesting and motivating activities that take advantage of children's curiosity; Developing values, attitudes, and behavior's that contribute to the creation of a healthy, sustainable socio-natural environment ; intention given to the children's active involvement in knowledge construction ;developing socio-emotional and cognitive skills ; integrating new technologies in preschool education ; Proposing thematic projects related to aspects of the children's daily lives and their output profiles ; coherence between the learning objectives and the proposed contents for the development of an initial scientific culture ; mentioning the discovery, observation, conceptualization, and reinvestment activities recognized as phases of the IBL , etc. However, other key aspects are ignored or treated inadequately or superficially (construction of school science aspects; significance of children's initial conceptions in the process of scientific knowledge construction or how to overcome them; importance of communicative interaction in knowledge construction; pedagogical approach being play-based learning whatever the targeted objective; usual learning space being limited to the classroom; skills desired being conceived in a discontinuity and compartmentalization framework; designing didactic proposals delegated to different publishers; criterion-based evaluation, etc.).

Preschool is a privileged context for introducing children to scientific culture. In fact, children have the capability to discover and practice the inquiry process that can support the development of various skills such as language and social skills, autonomy, creativity, logical and critical thinking, etc. Despite the recognition of the importance of a scientific and technological awareness in society from an early stage, several reports have shown that this educational component is marginalized in preschool. Science teaching is often approached in a magisterial way. The richness of children's questioning, their innate curiosity, their experiences, and their interactions are then ignored. The reasons are diverse: it may be, among others, a priority given to the so-called fundamental learning of "reading, writing, and counting", a lack of pedagogical material, or the self-confidence of the educators that they are not competent enough to answer children's scientific questions. In addition to these factors, there is often a lack of information and training on the characteristics of inquiry-based science learning and its implementation in the classroom.

Despite the fact that the curriculum is not intended to be applied as such but rather as a potential source of professional development and questioning, it remains an essential reference for educational equity and quality. Thus, the reformer should be better informed about the current curriculum's limitations as well as the issues associated with curriculum development, particularly their systemic dimension, in order to ensure teaching coherence.

It also appears necessary to redefine the roles that curriculum developers, teachers, and researchers can play in curriculum development. If it is necessary to grant autonomy, flexibility, and trust to educational teams, it seems difficult to delegate such heavy responsibility to single teachers.

This study outlines avenues for future didactic research. It invites discussion of the coherence of the entire curriculum, the relevance of prescribed content, and the conditions for acquiring what is required of all students in the end of compulsory school. Future studies involving professionals, educators, and researchers to design instructional sequences using an ascending approach are of great interest.

Recommendations

The document analyzed is generic and open-ended. It is complemented by the publication of a pedagogical guide that facilitates its interpretation and application by educators. However, it remains a national reference and a practical and methodological orientation guide that defines the basic parameters to be respected in PSE. This requires making it a pedagogical support that conveys in an adequate and precise way the didactic and methodological characteristics suggested by current trends in SA. To this end, proposals have been made to improve the actual position of the CFPE toward SA:

- Preschool science activities should be built based on children's previous experiences and initial conceptions.
- Social interaction, exchange, and confrontation of ideas allow knowledge building on a similar cognitive level and encourage cooperative learning that helps children with learning difficulties and enriches those who are more advanced.
- Guidelines should be defined for introducing children to the inquiry process. It will allow them, in addition to acquiring socio-affective skills, to integrate a systematic model that involves them in observation, questioning, prediction, experimentation, synthesis, and sharing results.

- Careful consideration must be given to the child's progressive engagement in a rich and varied inquiry-based learning context. First, learn to observe in a methodical way; second, learn to verbalize what is observed; third, progressively increase the number of aspects to be observed around the same phenomenon; and fourth, make a first transition from simple description to explanation of the observed aspects.
- More attention should be paid to the skill of "learning to learn" by encouraging curiosity and instilling in the child a sense of autonomy toward knowledge.
- It also seems essential to propose guidelines for addressing the compartmentalization of contents and skills by offering multidisciplinary approaches that support developing several skills simultaneously.
- More attention should be given to specific resources and strategies to promote scientific literacy in the classroom (science experiment corners or workshops, didactic manipulatives, pre-school educational kits) or outside the classroom (extracurricular education programs).
- Encourage the participatory approach by involving educators in conceiving suitable didactic proposals.
- An incentive to integrate science didactics training for preschool educators is of great interest.
- Paying attention to the participatory dimension of children in the evaluation process by proposing tools such as portfolios, checklists, charts, etc.
- Integrating ICTs in the evaluative process allowed the accumulation of a sufficient number of traces: photos of the children's productions and video sequences illustrating children's behavior in different activities carried out.
- Favoring a criterion-based evaluation that allows the collected data to be compared with previously established criteria.
- Training educators in designing and using various evaluation tools enables them to assess targeted skills and essential knowledge.

Limitations

It cannot be denied that this program is still in its infancy and that it is the result of the thoughts of a few professionals who, at the time of its development, were thinking about abstract children and teachers. Almost none of the recommendations are based on observations of kindergarten classroom daily life. Certainly, there is feedback that allows for the redefinition of certain dimensions that should be included, modified, or removed from the official curriculum.

We also recognize that simply including the suggestions listed above in a formal document does not guarantee that teachers will implement them in their classrooms. However, we are equally certain that if they are left out of the framework document, their impact on the classroom will be imperceptible, as they are unlikely to be considered essential.

Authorship Contribution Statement

Ouabich: Conceptualization, design, analysis, writing. Tifroute: Reviewing, supervision. Bounabe: Analysis, writing, reviewing.

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