

SPACED LEARNING IN SECONDARY SCHOOL: A CROSS-BORDER TEACHING PROPOSAL

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Abstract

Spaced learning is a teaching methodology that structures time to optimize students' attention, concentration, and long-term memory consolidation. Kelley and Watson (2013) developed this approach to investigate whether delivering brief inputs at structured intervals could facilitate the encoding of complex information into long-term memory. This methodology frames the educational setting as a dynamic environment capable of fostering students' active engagement and metacognitive awareness. Building on these premises, this study aims to design and test a spaced learning pathway within upper secondary education, specifically targeting core subjects in vocational institutes for food and wine services and hospitality. The objective is twofold: to enhance learning outcomes in vocational subjects and to promote inclusion and school well-being, which are central to educational quality and academic success. The five-phase educational intervention comprises three cognitive input sessions interspersed with two breaks featuring distracting activities. Within this framework, motor activity plays a strategic role, supporting knowledge consolidation by integrating bodily experience with cognitive processes. This approach is particularly relevant from an inclusive perspective, as it may prove especially effective for students with special educational needs, fostering a more accessible, participatory, and motivating learning environment. Operationally, the pathway alternates lesson time with ten-minute sessions of motor activities and interactive games, aiming to support a more effective, relaxed, and meaningful learning process. Applying spaced learning to vocational subjects in food and wine studies and hospitality is thus intended not only to strengthen technical skills but also to positively influence participation, inclusion, and perceived well-being. The experimental research will be conducted over two years, involving a sample of 500 students equally distributed between Italy and Tunisia. Through this comparative and transnational perspective, the study seeks to analyze the methodology's effectiveness across different educational contexts, contributing to the scientific debate on innovative teaching strategies oriented toward academic success, inclusion, and the promotion of well-being at school.

Keywords: *Inclusion, physical activity, school well-being, spaced learning, upper secondary school.*

1. Introduction

In recent years, the pedagogical debate has increasingly focused on developing teaching methodologies capable of effectively responding to the complexity of contemporary educational contexts, with particular attention to learning quality, inclusion, and school well-being. From this perspective, spaced learning represents an innovative approach based on a specific temporal organisation of teaching and learning activities, aimed at optimising attention, concentration and long-term memory consolidation. As highlighted in the theoretical framework of the project, the spacing format adopted was defined based on empirical evidence and the model proposed by Kelley and Watson (2013), in dialogue with the teachers involved in the experimentation. The experimental project AMIE' (*Apprendre en mouvement pour l'inclusion à l'école*) is situated within this theoretical and methodological horizon and aims to optimise and implement spaced learning in the core subjects of vocational institutes for food and wine services and hotel hospitality. The project involves Italian and Tunisian schools and is promoted and coordinated by the research group of the University of Palermo, Department of Psychology, Educational Science and Human Movement (SPPEFF). It aims to test a teaching methodology and evaluate its impact on learning, verifying its effectiveness and efficiency in educational contexts, with particular attention to upper secondary education. The project arises from a holistic approach to the educational-training process, grounded in a careful reading of educational needs and the need to promote truly meaningful learning through the support

of neuroscience. From this perspective, this paper presents the theoretical foundations, research design, and evaluation framework of the project, highlighting its pedagogical and scientific value. As the research is still ongoing, the text does not report final results but offers an articulated reflection on an experiment that seeks to integrate disciplinary learning, motor activity, inclusion and well-being into a unitary framework.

2. Theoretical framework

Spaced learning is based on the idea that the temporal organisation of teaching activities significantly affects information encoding and retention. In this direction, Kelley and Watson (2013) helped define a model based on the repetition of brief cognitive inputs, interspersed with distracting breaks, to facilitate long-term memory consolidation. Within the AMIE' project, this model has been reinterpreted from an educational perspective and contextualised in upper secondary school through an operational structure shared with teachers. Further theoretical contributions help explain the logic of spacing. Karpicke and Bauernschmidt (2011) distinguish between absolute and relative spacing, arguing that a greater overall interval between repetitions can improve information retention. Carpenter et al. (2012) also emphasise that different forms of spacing can support learning and long-term memory, while Cepeda et al. (2006) show that longer retention intervals and more frequent repetitions increase the likelihood of correct recall. The project incorporates these theoretical indications, while recognising that excessively long intervals may lead to forgetting and reduce the method's effectiveness. A distinctive aspect of the AMIE' proposal is the integration between spaced learning and motor activity. Based on the studies of Gomez Paloma, Ianes and Tafuri (2017), the project foresees that the breaks are filled with motor exercises, physical activity and body movements. This choice fits into an embodied view of learning, according to which the body is not an accessory element of the educational process but a constitutive dimension of knowledge construction. From this perspective, the shift from teacher-centred direct instruction to student-centred experiential learning fosters understanding, application of knowledge in authentic situations, and personalised learning. The project also adopts a clear inclusive perspective. It aims to verify the implications of spaced learning also for students in difficulty and/or with disabilities, in the belief that methodological innovation should be evaluated not only in terms of cognitive effectiveness but also regarding its capacity to make the school environment more accessible, participatory and motivating. In this sense, inclusion and well-being are not accessory dimensions but core components of educational quality.

3. Research objectives

The general aim of the research is to initiate a reflection on the school context in order to: compare the applicability, generalisation and transferability of alternative methodologies compared to ordinary ones; verify the efficiency of the research programme in improving learning outcomes and measures of equity and inclusion; develop pedagogical-didactic recommendations and operational guidelines useful to inform future policies and actions in the field of education and training. Based on these aims, the project intends to: promote meaningful learning in the core subjects of vocational institutes for food and wine services and hotel hospitality; verify the effectiveness of spaced learning in upper secondary school contexts; analyse the impact of the integration between cognitive inputs and motor activity; evaluate the effects of the intervention in terms of inclusion and school well-being; observe the transferability of the model from a comparative and cross-border perspective between Italy and Tunisia.

4. Methodology and research design

The project adopts an experimental design articulated in several phases. An initial preparatory phase is aimed at defining the general operational framework. This is followed by a design phase of approximately three months, dedicated to the operational formulation of hypotheses, identification of variables of interest, sample selection, and definition of timing and instruments. The model implementation, testing and experimental verification phase develops over approximately six months and includes the administration of initial tests, shared re-modulation of the intervention, and the implementation of the training pathway. Subsequently, an outcome evaluation phase of approximately four months is planned, followed by a final phase, also of approximately three months, dedicated to drafting the final report and disseminating the research results. The project also includes a training and co-construction action with teachers, initiated through seminars at the partner schools and accompanied by periodic moments of reflection, sharing, and re-modulation of activities. Data collection is structured into three main moments: an initial baseline, carried out through pre-test disciplinary tests; a teacher training phase on the spaced learning methodology, based on its neuroscientific and methodological-didactic foundations; and a data

collection and analysis phase at the beginning and end of the application of the innovative methodology. In addition, an anamnestic questionnaire is administered to teachers to collect information on the context, characteristics of the classes, and the possible presence of students with special educational needs. The research involves a sample of 500 students, equally distributed between Italy and Tunisia, thereby assuming a strong comparative and transnational value. This choice allows not only to verify the effectiveness of the model in different educational contexts but also to reflect on its transferability to school systems characterised by different cultural and organisational conditions.

5. Structure of the teaching intervention

From an operational point of view, the project has identified that activities developed with the spaced learning method are particularly suitable when carried out in two consecutive hours per day. The adopted format foresees two distracting breaks of 10 minutes every 30 minutes of lesson, for a total duration of 120 minutes. On this basis, a scheme for structuring lesson units and teaching activities was built together with the teachers. The protocol is organised into five phases, comprising three input moments and two breaks. In the first input phase, the teacher presents the information that students are expected to learn during the lesson. This phase lasts 30 minutes. It is followed by a 10-minute break during which no reference is made to the content covered; motor proposals are intended to distract from the didactic moment through physical activation. In the second input, also lasting 30 minutes, the teacher takes up and re-elaborates the previously presented content. Subsequently, a second break is inserted, structured according to the same logic as the first. Finally, in the third input, the teacher maintains the focus on the content of the first session, and students can demonstrate that they have acquired the knowledge transmitted, apply it in practical exercises or problem-solving situations, and ask questions. Although well defined in its temporal structure, this format leaves room for flexibility. The teacher can adapt the intervention methods to the needs of the class and the specificities of the subject matter, calibrating the lesson to promote active learning and interaction, while remaining within a rigorous methodological framework.

6. Assessment instruments

A particularly relevant element of the project is the breadth and multidimensionality of the evaluation framework. Starting from the analysis of the literature, the project has foreseen specific instruments for measuring inclusivity and well-being, motor abilities, cognitive abilities, and disciplinary skills. For the assessment of inclusivity and well-being, the following instruments are used: the Perceived Stress Scale (Cohen et al., 1983), the Pittsburgh Sleep Quality Index (Buysse et al., 1989), the Satisfaction With Life Scale (Diener et al., 1985), the Trait Meta-Mood Scale-24 (Salovey et al., 1995), the Short Form Health Survey (Ware et al., 1996), the WHO-5 Well-Being Index (World Health Organization, 1998), the Positive and Negative Affect Schedule (Watson et al., 1988), the questionnaire on inclusive quality (Ferrara, 2021), and the Multicage-TIC (Pedrero Pérez et al., 2018). These tools allow to detect perceived stress, sleep quality, life satisfaction, emotional regulation, quality of life, psychological well-being, affective states, inclusive quality of the context, and problematic use of technologies. Motor abilities are measured using the International Physical Activity Questionnaire (Craig et al., 2003), while cognitive abilities are assessed through the Metacognitions Questionnaire-30 (Wells & Cartwright-Hatton, 2004) and the reduced Learning Strategies Questionnaire (Pellerey, 1996). Finally, for the analysis of disciplinary skills, specific tests related to practical and theoretical competences in cooking and restaurant service, as well as gastronomic history, have been developed. This framework appears highly coherent with the project aims, as it allows evaluating the impact of the intervention not only on disciplinary learning but also on cognitive, motor, emotional, and inclusive dimensions.

7. Towards the experimentation: theoretical and methodological openings

The AMIE' project appears particularly significant for at least three reasons. First, it applies spaced learning to a still scarcely explored sector, namely upper secondary vocational education. Second, it integrates the spacing methodology with motor activity, attributing to the body a structural function in the learning process. Third, it places inclusion and equity dimensions at the centre of the intervention, recognising that educational quality cannot be reduced to cognitive performance alone. The project also shows awareness of the limitations and criticalities associated with the application of spaced learning. The document highlights, in fact, that the methodology requires teachers to invest more effort in planning, special care in classroom management, and the availability of spaces, materials, and technological tools that are not always present in schools. Among the weaknesses mentioned are the risk of confusion during breaks in large classes and the increased workload for lesson preparation. However, this methodological

awareness reinforces the scientific robustness of the project. Attention to teacher training, the rigorous structuring of the protocol, the plurality of evaluation instruments, and the comparative dimension between Italy and Tunisia confer significant potential to the research, both empirically and in terms of pedagogical reflection. The project proposes a theoretically grounded and methodologically structured experimentation of spaced learning in upper secondary education, with particular reference to vocational institutes for food and wine services and hotel hospitality. The intervention integrates repeated cognitive inputs, motor breaks, and a multidimensional assessment of outcomes, with the aim of promoting meaningful learning, inclusion, and school well-being. Although the research is still ongoing and no final data are yet available, the project already offers a relevant contribution to the debate on innovative teaching methodologies. It suggests that spaced learning may constitute not only a technique for improving memory consolidation but also a lever for rethinking the relationship between teaching, body, participation, and the quality of school life. In this sense, the cross-border perspective between Italy and Tunisia further broadens the scope of the research and strengthens its scientific and pedagogical relevance. Future empirical findings will allow to verify the effectiveness of the model and to refine the operational recommendations for teachers and policymakers.

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