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mjhs@um.edu.mt

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Teaching for confidence

Trevor Abela Fiorentino

Head, Department of Nursing, Faculty of Health Sciences, University of Malta, Msida, Malta.

Healthcare education has made substantial strides in ensuring that students develop into competent professionals. The acquisition of knowledge and technical competence have been long prioritised in healthcare education, with students being rigorously examined on their ability to recall information and perform clinical tasks. As such, healthcare curricula and educational frameworks are intentionally designed to ensure that graduates emerge as knowledgeable and competent practitioners (Monrouxe & Bloomfield, 2023). However, despite the strong emphasis on competence within healthcare education, uncertainty and hesitation remain prevalent among new graduates. Many appear to lack the professional confidence required for independent practice, even after being certified as knowledgeable, skilful, and clinically competent (Alharbi et al., 2023; Carpio et al., 2025; Najafi & Nasiri, 2023).

Competence and confidence are not synonymous, nor does confidence automatically emerge from competence (Bäck et al., 2017). While students may demonstrate excellent knowledge retention and procedural skill in controlled assessment environments or under the strict supervision of a clinical mentor, they may struggle to act decisively within the complexity of real clinical practice. It may be the case that insufficient conscious attention is currently given to helping students develop the ability to apply their knowledge and translate that competence into confident clinical action. While students are trained to prioritise memorisation and application of knowledge, accuracy in performance, and appropriate behaviour (Lujan & DiCarlo, 2025), the complexity of

clinical environments requires new graduates to be able to navigate uncertainty with confidence.

Healthcare settings are inherently complex, dynamic, and emotionally charged. Patients and their significant others do not experience care and competence as abstract constructs, checklists of correctly performed tasks or examination outcomes. Instead, care and competence are experienced through the actions of healthcare professionals, their presence, interaction, communication, and other constructs of confidence (Roos et al., 2023). A clinician who appears unsure, even when clinically correct, may unintentionally undermine the trusting relationship. In contrast, confidence expressed through calm communication, clear decision-making and professional presence fosters reassurance, safety, and a stronger professional and patient relationship based on trust.

A dissonance seems to exist between what healthcare education teaches and measures, and what clinical practice requires. This raises important questions about whether current pedagogical and assessment approaches, with their strong emphasis on knowledge acquisition and task performance, sufficiently support the development of confident practitioners.

In this view, current educational and assessment strategies may be inadvertently rewarding performance over formation. High-stakes examinations, standardised competencies, and repeated task-based assessments signal to students that success lies in getting the right answer and avoiding failing criteria. Needless to say, mastery of knowledge and skill is essential. However, an overemphasis on this type of educational success may discourage students from engaging openly with uncertainty, asking questions or developing their professional voice. In such environments, learners may become proficient at passing theory and practice examinations, but remain reluctant to advocate for patients or trust their own clinical reasoning. The result

Correspondence to Trevor Abela Fiorentino

trevor.abela-fiorentino@um.edu.mt

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is a graduate who is knowledgeable and competent, but not truly confident (Price-Dowd, 2017).

Confidence is not a fixed personality trait possessed by some and absent in others. Rather, it is a professional capability that is developed through supported practice, meaningful feedback, and reflective learning. Confidence grows when students are encouraged to articulate their reasoning, make decisions under supervision, and learn constructively from mistakes. When educational cultures frame uncertainty as failure rather than as an inherent feature of clinical practice, students may internalise doubt and a sense of lack of competence, rather than develop professional confidence.

Teaching for confidence, therefore, requires intentional educational design. This includes creating curricula where questioning is welcomed, uncertainty is named, and feedback attends to not only what students did, but how they reasoned and how they carried themselves in clinical encounters. Such an educational design also requires that healthcare educators model professional confidence, demonstrating how to communicate uncertainty honestly while maintaining a therapeutic presence. It also requires assessment practices that value growth, judgement and reflective capacity, rather than solely the reproduction of knowledge and procedural correctness.

To bridge this gap, healthcare education must move beyond the memorisation and checklist mentality. Simulation training and clinical placements have been advocated for in an attempt to bridge this gap (Daneshfar & Moonaghi, 2025). However, they are insufficient in isolation. To truly solidify professional confidence, we must integrate structured debriefing and critical reflection as core components of the curriculum, rather than optional adjuncts. Debriefing creates the psychologically safe space required to deconstruct performance, confront uncertainty, and reconcile theoretical knowledge with clinical reality (González-Tejerina et al. 2023). It is within these reflective cycles that competence is transformed into confidence (Bowers et al., 2025). For this to be effective, assessment frameworks must also evolve. Current rubrics often penalise hesitation and reward rote adherence to protocol. We must therefore shift toward assessment strategies that value professional judgment, the ability to navigate ambiguity, and the capacity for self-correction.

Ultimately, as healthcare educators, we are not just training technicians; we are forming clinicians.

By rebalancing our curricula to prioritise both the "knowing" and the "feeling" of practice, we must ensure that our graduates are not only certified as competent but are truly ready to care and lead with confidence at the bedside. Patients deserve healthcare professionals who are not only knowledgeable and technically competent, but who are also confident in their presence, communication and decision-making.

Such confidence enables healthcare professionals to advocate for patient safety, to navigate complexity efficiently and to build trust in moments of vulnerability. As educators, we not only shape what students know, but also how they show up in practice as professionals. If confidence is essential for safe, compassionate and effective care, then it cannot be left to chance. Teaching for confidence must be made an explicit educational goal. A goal that is intentionally cultivated, deliberately supported and thoughtfully assessed within healthcare education.

References

- Alharbi, H. F., Alzahrani, J., Hamed, A., Althagafi, A., & Alkarani, A. S. (2023). The experiences of newly graduated nurses during their first year of practice. *Healthcare*, 11(14), Article 2048. <https://doi.org/10.3390/healthcare11142048>
- Bäck, L., Hildingsson, I., Sjöqvist, C., & Karlström, A. (2017). Developing competence and confidence in midwifery: Focus groups with Swedish midwives. *Women and Birth*, 30(1), e32–e38. <https://doi.org/10.1016/j.wombi.2016.08.004>
- Bowers, M., Terry, D., & Irwin, P. (2025). The impact of reflective practice on nursing students: A scoping review. *Nurse Education in Practice*, 87, Article 104468. <https://doi.org/10.1016/j.nepr.2025.104468>
- Carpio, L. B., Covarrubias, S., Nollado, S., & Samson, M. A. (2025). Restricted and hands-on clinical experience on patient care: Effects on the confidence and integrity of care among nursing students. *Environment and Social Psychology*, 10(4), 3528. <https://doi.org/10.59429/esp.v10i4.3528>
- Daneshfar, M., & Moonaghi, H. K. (2025). The impact of clinical simulation on bridging the theory–practice gap in nursing education: A systematic review. *BMC Medical Education*, 25(1). <https://doi.org/10.1186/s12909-025-07790-8>

- González-Tejerina, B., Pérez-Corrales, J., Palacios-Ceña, D., Abad-Valle, J., Gómez, P. R., González-Toledo, B., García-Carpintero Blas, E., & Garrigues-Ramón, M. (2025). Nursing students' perceptions of clinical debriefing TALK©: A qualitative case study. *Nursing Reports*, 15(6), 194–214. <https://doi.org/10.3390/nursrep15060194>
- Lujan, H. L., & DiCarlo, S. E. (2025). The paradox of knowledge: Why medical students know more but understand less. *Medical Science Educator*. <https://doi.org/10.1007/s40670-025-02379-8>
- Monrouxe, L. V., & Bloomfield, J. (2024). Editorial: Insights in healthcare professions education: 2023. *Frontiers in Medicine*, 11. <https://doi.org/10.3389/fmed.2024.1438116>
- Najafi, B., & Nasiri, A. (2023). Explaining novice nurses' experience of weak professional confidence: A qualitative study. *SAGE Open Nursing*, 9, 1–9. <https://doi.org/10.1177/23779608231153457>
- Price-Dowd, C. (2017). Confidence and competence is what makes the difference on the frontline. *British Journal of Nursing*, 26(15), 900–901. <https://doi.org/10.12968/bjon.2017.26.15.900>
- Roos, A. K. Ø., Skaug, E.-A., & Helgesen, A. (2023). The importance of being taken care of: Patients' experience with the quality of healthcare in a Norwegian hospital. *Nursing Reports*, 13(4), 1742–50. <https://doi.org/10.3390/nursrep13040144>

Effects of Pilates on Low Back Pain: A Scoping Review

Janette Falzon

Department of Physiotherapy, Faculty of Health Sciences, University of Malta, Msida, Malta.

Anabel Sciriha

Department of Physiotherapy, Faculty of Health Sciences, University of Malta, Msida, Malta.

Tonio Agius

Department of Physiotherapy, Faculty of Health Sciences, University of Malta, Msida, Malta.

Abstract

The purpose of this scoping review was to map and synthesise the existing literature on Pilates-based interventions for low back pain (LBP), with particular attention to reported outcome domains, programme characteristics, and delivery context, and to identify gaps to inform future research and clinical practice. This scoping review was conducted in accordance with the Joanna Briggs Institute methodology and the PRISMA-ScR framework. Searches were performed in August 2025 using Google Scholar and HyDi (including Medline, Embase, CINAHL, Cochrane Library, PEDro, and Scopus). Eligible studies included randomised controlled trials and systematic reviews or meta-analyses involving adults with non-specific or subacute LBP in which Pilates was the primary intervention. Data were charted on population characteristics, intervention format, dose, supervision, comparator, and reported outcomes across clinical and psychosocial domains. Findings were synthesised narratively. The literature predominantly reports outcomes related to pain intensity, functional disability, and health-related quality of life, with fewer studies assessing psychosocial variables such as kinesiophobia or fear of movement. Pilates interventions varied substantially in delivery format (mat versus equipment-

based), frequency, duration, and level of supervision. Across studies, Pilates was commonly compared with minimal intervention or other exercise approaches, with short-term improvements in patient-reported outcomes frequently described. However, heterogeneity in intervention protocols, outcome measures, follow-up duration, and reporting of instructor qualifications limited cross-study comparability. Reporting of mechanistic outcomes and long-term follow-up was sparse. This scoping review demonstrates that the current literature on Pilates for LBP is characterised by diverse intervention approaches and outcome reporting, with a primary focus on pain and disability outcomes. While Pilates is commonly positioned as a guideline-consistent exercise option, important gaps remain regarding patient selection, instructor expertise, mechanistic pathways, and long-term outcomes. Future research should prioritise standardised reporting of intervention characteristics, broader biopsychosocial outcome assessment, and clearer description of delivery context to support more definitive evaluations.

Key Words: Pilates, Low Back Pain, Rehabilitation, Exercise Therapy, Psychosocial outcomes, Physiotherapy

1. Introduction

Low back pain (LBP) is considered one of the most prevalent musculoskeletal disorders from a global perspective, with lifetime prevalence estimates ranging from 60% to 80% in most populations (Hoy et al., 2014). It is the leading cause of years lived with disability worldwide (Vos et al., 2020) and imposes substantial socioeconomic costs through healthcare utilisation and

Correspondence to Jeanette Falzon

janette.falzon.14@um.edu.mt

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lost productivity (Hartvigsen et al., 2018). Most LBP cases are non-specific, meaning no underlying pathology such as fracture, infection, or malignancy is identified (Maher et al., 2017). Despite being non-life-threatening, LBP often becomes chronic or recurrent, leading to functional impairment and reduced quality of life.

International clinical guidelines consistently recommend active, non-pharmacological approaches as first-line management for non-specific LBP. The American College of Physicians guideline (Qaseem et al., 2017) emphasises structured exercise programmes, spinal manipulation, and multidisciplinary rehabilitation as preferred over passive modalities such as rest, ultrasound, or electrotherapy. The UK National Institute for Health and Care Excellence (NICE, 2016) also advises group exercise programmes, including Pilates, yoga, or tai chi, as core components of conservative management for persistent LBP. The rationale underlying these recommendations is that active approaches promote self-management, physical conditioning, and psychosocial resilience, whereas passive interventions offer limited or short-term benefit. Against this backdrop, Pilates has emerged as a popular rehabilitation option. Developed by Joseph Pilates in the early 20th century, Pilates integrates physical and mental components through controlled movement, breathing coordination, and postural alignment (Latey, 2001). Pilates can be delivered in mat-based formats, using bodyweight and small props, or equipment-based formats, involving spring-resistance machines such as the Reformer or Cadillac. Its theoretical relevance to LBP rehabilitation lies in emphasising deep trunk muscle activation, spinal and pelvic stability, and movement control, as well as addressing cognitive and behavioural factors such as body awareness and pain beliefs (Wells et al., 2012).

Although multiple systematic reviews and meta-analyses have examined Pilates-based exercise for LBP, the existing literature presents several unresolved limitations. Most reviews have focused primarily on pooled effects for pain and disability outcomes, with less attention to intervention characteristics such as exercise dose, delivery format (mat versus equipment-based), supervision, or instructor expertise (Patti et al., 2015; Yu et al., 2023). Furthermore, psychosocial outcomes that are increasingly recognised as central to LBP management—such as kinesiophobia, fear-avoidance behaviour, and patient confidence—are inconsistently reported or excluded from quantitative syntheses (Wells et al., 2014; Maher et al., 2017).

In addition, prior reviews often apply restrictive inclusion criteria focused on chronic LBP or specific comparator interventions, which may obscure important variation across populations, programme designs, and clinical contexts. As a result, clinicians and policymakers are left with limited guidance on how Pilates is delivered in practice, which patient groups may be most suitable, and which components of Pilates-based programmes are most commonly associated with reported benefits. Recent methodological guidance highlights the value of scoping reviews in situations where the evidence base is heterogeneous, outcomes are variably reported, and conceptual clarification is required prior to more definitive effectiveness evaluations (Munn et al., 2018; Peters et al., 2020).

Therefore, a scoping review is warranted to comprehensively map the breadth of Pilates interventions used for LBP, summarise reported outcome domains across clinical and psychosocial dimensions, and identify key gaps in intervention reporting, patient selection, and delivery context. Such mapping is necessary to inform future high-quality trials, improve consistency in reporting, and support more targeted and clinically meaningful application of Pilates in LBP management.

2. Methods

This scoping review was conducted and reported in accordance with the PRISMA extension for Scoping Reviews (PRISMA-ScR). All applicable checklist items were addressed; items relating to critical appraisal and quantitative synthesis were not applicable, as risk of bias assessment and meta-analysis are not mandatory components of scoping reviews.

Eligibility criteria were defined a priori. Included studies met the following: (a) adults (≥ 18 years) with non-specific, occupational, or subacute LBP; (b) Pilates as the primary intervention (mat and/or equipment), delivered individually or in groups; (c) comparator could be no intervention, usual care, other exercise, or other physical therapies; (d) outcomes included pain, functional disability, quality of life, psychosocial measures (e.g., kinesiophobia), or adverse events; (e) randomised controlled trial or systematic review/meta-analysis design; (f) available in English in a peer-reviewed journal. Studies focusing on specific spinal pathologies or post-surgical populations were excluded unless $\geq 80\%$ of participants had non-specific LBP.

The search was conducted on 14 August 2025 using two primary platforms: Google Scholar, to identify recent peer-reviewed and indexed literature; and HyDi, the University of Malta Library's discovery system, which aggregates databases including Medline, Embase, CINAHL, Cochrane Library, PEDro, and Scopus. Search terms included: "Pilates AND low back pain AND randomised controlled trial," "Pilates chronic low back pain meta-analysis," and "Pilates AND lumbar pain," adapted with Boolean operators and truncation for database syntax. Articles used for this review are listed in Table 1. Google Scholar was included to capture recently published and cross-disciplinary literature not always indexed consistently in traditional biomedical databases. Searches were conducted using predefined keyword combinations, and results were screened in order of relevance as ranked by Google Scholar. The first 200 records for each search string were reviewed, consistent with published methodological recommendations for Google Scholar searches. Reference lists of included articles were also screened to identify additional relevant studies.

The search term "meta-analysis" was applied primarily in combination with chronic low back pain to reflect the focus of existing quantitative syntheses in this population and to avoid retrieval of meta-analyses from heterogeneous or acute pain contexts that were outside the scope of this review.

The characteristics of the included studies are summarised in Table 1, including study design, population, intervention characteristics, comparators, and reported outcomes. Any duplicates were removed, following which titles and abstracts were screened for eligibility. Reasons for exclusion were documented. Data were extracted using a standardised charting form capturing bibliographic details, study design, population characteristics, intervention type, comparator, duration, outcome measures, main findings, and adverse events. As this was a scoping review, no formal risk of bias assessment or meta-analysis was performed; results were synthesised narratively (Munn et al., 2018). This process can be viewed in Figure 1).

Table 1: Included Studies

Author (Year)	Design	Population	Intervention	Comparator	Duration	Primary Outcomes	Main Findings
Tottoli et al. (2024)	RCT	Adults 18–50 with chronic non-specific LBP (n=145)	Mat Pilates twice/week, 6 weeks	Home-based exercises	6 weeks + 6-month follow-up	Pain, disability, HRQoL	Pilates superior at post-intervention for pain, disability, HRQoL; only HRQoL difference persisted at 6 months; clinical differences modest
Vera-Saura et al. (2024)	RCT (double-blind)	Adults 18–65 with chronic Non-specific LBP (n=67)	Pilates with mind–body cueing, twice/week, 8 weeks	Same Pilates without cueing	8 weeks	Pain (VAS), disability (RMQ), kinesiophobia (TSK)	Both groups improved; mind–body cueing led to greater reduction in kinesiophobia
da Luz Jr. et al. (2014)	RCT	Chronic non-specific LBP (n=86)	Equipment-based Pilates	Mat Pilates	Treatment + 6-month follow-up	Disability, kinesiophobia, pain	Equipment-based superior to mat at 6 months for disability & kinesiophobia; not for pain
Miyamoto et al. (2018)	RCT with economic evaluation	Chronic LBP	Different doses of Pilates-based exercise	Lower vs higher dose	Varied	Pain, disability, cost-effectiveness	Dose influences outcomes and cost; higher doses showed greater short-term benefits (details vary by measure)
Coelho et al. (2025)	RCT	Chronic Non-specific LBP	High-intensity Pilates	Low-intensity Pilates	—	Pain, disability	Similar effects between intensities
Asik & Sahbaz (2025)	RCT	Subacute LBP	Pilates-based program (8 weeks)	Home exercise	8 weeks	Pain, disability	Pilates improved outcomes vs home exercise in subacute LBP
Rossetti et al. (2023)	RCT	Older adults with chronic LBP	Pilates + pain neuroscience education	Education only	—	Pain, function, fear of movement	Pilates safe; greater improvements on several outcomes vs control
Stieglitz et al. (2016)	RCT	Workers with chronic LBP	Equipment-based Pilates	Back care/physiotherapy programs	—	Pain, disability	Equipment-based Pilates reduced work-related CLBP more than comparators

Table 1: Included Studies

Author (Year)	Design	Population	Intervention	Comparator	Duration	Primary Outcomes	Main Findings
Fernández-Rodríguez et al. (2022)	Network meta-analysis of RCTs	Adults with chronic LBP (118 trials)	Pilates vs other exercise types	Various	—	Pain, disability	Pilates among most effective for pain & disability (high SUCRA rankings)
Yu et al. (2023)	Systematic review & meta-analysis	Chronic LBP	Pilates	No exercise/ other exercise	—	Pain, function, QoL	Pilates improves pain, function, QoL vs controls
Patti et al. (2024)	Systematic review & meta-analysis	LBP (mixed)	Pilates	No or other exercise	—	Pain, disability	Pilates decreases LBP vs no and non-specific exercise
Patti et al. (2015)	Systematic review	Chronic LBP	Pilates programs	Usual care/ other	—	Pain, function	Early evidence of effectiveness; heterogeneity noted

VAS: Visual Analogue Scale; RMQ: Roland Morris Disability Questionnaire; TSK: Tampa Scale of Kinesiophobia; SUCRA: Surface Under the Cumulative Ranking Curve

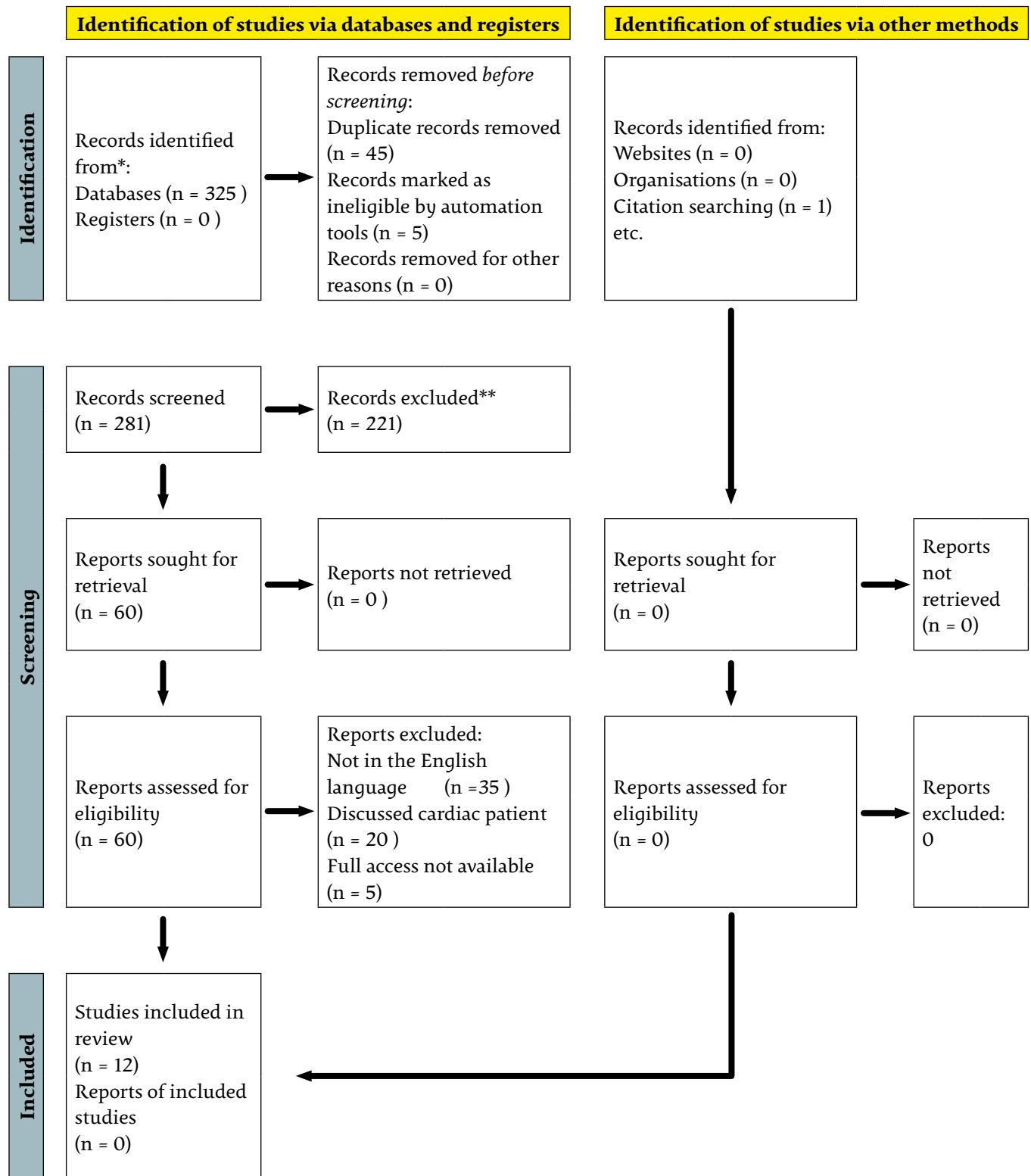


Figure 1. PRISMA flow diagram outlining the search process in this study

From "The PRISMA 2020 statement: an updated guideline for reporting systematic reviews." Page et al., (2021), British Medical Journal (372), n71. doi:10.1136/bmj.n71

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Narrative synthesis was conducted using a structured, iterative approach. Extracted data were first grouped by study design and intervention characteristics, including Pilates format (mat or equipment-based), frequency, duration, supervision, and comparator type. Outcomes were then categorised into clinical (pain, disability, quality of life), psychosocial (e.g. kinesiphobia, fear of movement), and safety-related domains. Patterns, consistencies, and divergences across studies were identified through repeated comparison, with attention to how programme characteristics and delivery context related to reported outcomes. This approach aligns with established guidance for narrative synthesis in scoping reviews.

3. Results

3.1. Study Selection

The database searches identified a total of 325 records. After removal of duplicates, 280 titles and abstracts were screened for eligibility. Following full-text review, 12 studies met the inclusion criteria and were included in this scoping review. Reasons for exclusion at the full-text stage included non-Pilates interventions, non-low back pain populations, and non-randomised or non-review study designs. The study selection process is summarised in the PRISMA flow diagram (Figure 1).

3.2. Characteristics of Included Studies

The included literature comprised randomised controlled trials and systematic reviews or meta-analyses published between 2014 and 2025. Most studies focused on adults with chronic non-specific low back pain, with fewer investigations addressing subacute presentations. Sample sizes varied widely across trials, and participant age ranges generally spanned early adulthood to older age groups.

Intervention duration ranged from six to twelve weeks, with session frequency varying from one to three sessions per week. Follow-up periods were predominantly short term, with only a limited number of studies reporting outcomes beyond six months. A summary of study characteristics, including population, intervention format, comparators, and outcome measures, is provided in Table 1.

3.3. Pilates Intervention Characteristics

Substantial heterogeneity was observed in Pilates programme design and delivery. Interventions included mat-based Pilates, equipment-based Pilates, and mixed-format programmes. Most interventions were supervised, though reporting of instructor qualifications and clinical training was inconsistent. Several trials specified delivery by physiotherapists or clinicians with musculoskeletal expertise, whereas others provided limited detail regarding instructor background.

Comparator interventions included home exercise programmes, education-only controls, physiotherapy-based programmes, and other structured exercise modalities. This variability in comparators further contributed to challenges in cross-study comparison.

3.4. Outcome Domains Assessed

Across the included studies, outcome assessment was predominantly focused on clinical domains. Pain intensity and functional disability were the most frequently reported outcomes, followed by health-related quality of life. In contrast, psychosocial outcomes such as kinesiphobia, fear of movement, or pain-related beliefs were assessed in a minority of trials. Adverse events were infrequently reported, though available data suggested that Pilates-based interventions were generally well tolerated.

Mechanistic outcomes related to neuromuscular control, motor coordination, or psychological mediators were rarely included, limiting insight into the pathways through which Pilates may influence clinical outcomes.

3.5. Summary of Reported Effects

Most randomised controlled trials reported short-term improvements in pain and disability following Pilates-based interventions compared with minimal or no intervention. Comparisons with other exercise modalities yielded mixed findings, with many studies reporting broadly similar effects between Pilates and alternative exercise approaches. Due to heterogeneity in intervention characteristics, outcome measures, and follow-up duration, direct comparison across studies was limited, and findings are best interpreted as descriptive patterns rather than definitive estimates of effectiveness.

4. Discussion

This scoping review mapped the breadth of Pilates-based interventions used in the management of LBP, synthesised patterns across reported clinical and psychosocial outcomes, and identified gaps in intervention reporting and evidence generation. The findings indicate that the existing literature is dominated by short-term trials focusing primarily on pain and disability outcomes, with substantial heterogeneity in programme design, delivery context, and comparator interventions.

4.1. Efficacy of Pilates for LBP

The findings of this scoping review indicate that Pilates can be effective in reducing pain, improving disability, and enhancing health-related quality of life (HRQoL) in people with chronic and subacute LBP. Across multiple RCTs, Pilates demonstrated superiority over minimal interventions such as home exercise programmes or education-only comparators (Asik & Sahbaz, 2025; Rossetti et al., 2023; Tottoli et al., 2024). Systematic reviews and meta-analyses further support this conclusion, consistently reporting that Pilates is more effective than no exercise in reducing pain and disability (Patti et al., 2015; Yu et al., 2023). These findings support guideline recommendations that structured, active exercise is a cornerstone of non-specific LBP management (NICE, 2016; Qaseem et al., 2017).

When compared with other structured exercise approaches, results are more mixed. While several reviews report Pilates to be broadly similar in efficacy to general exercise (Patti et al., 2024; Yu et al., 2023), a large network meta-analysis positioned Pilates among the most effective interventions for reducing pain and disability across 118 trials (Fernández-Rodríguez et al., 2022). These findings suggest that Pilates may not always confer unique benefits beyond other exercise forms but can nonetheless be considered an effective, guideline-consistent modality.

4.2. Influence of Dose, Format, and Programme Design

Evidence indicates that Pilates outcomes may be influenced by programme characteristics. For instance, da Luz Jr. et al. (2014) found equipment-based Pilates to offer better outcomes to mat Pilates in reducing disability and kinesiophobia at six-month follow-up,

whereas Coelho et al. (2025) reported no significant difference between protocols. Miyamoto et al. (2018) highlighted dose as a key factor, with higher-frequency programmes showing greater short-term improvements in pain and disability, although these were offset by increased resource requirements. Furthermore, Tottoli et al. (2024) demonstrated that Pilates improved pain and disability in the short term, though only HRQoL benefits persisted at six-month follow-up, suggesting that programme duration and long-term adherence are critical determinants of sustained benefit.

The integration of mind-body elements also appear influential. Vera-Saura et al. (2024) found that the addition of explicit mind-body cueing enhanced reductions in kinesiophobia compared with conventional Pilates, suggesting that the psychosocial dimensions of Pilates practice may provide unique benefits. This aligns with the theoretical basis of Pilates, which emphasises controlled breathing, concentration, and movement awareness (Wells et al., 2012).

4.3. Mechanistic Considerations

Although the rationale for Pilates in LBP rehabilitation lies in its potential to target deficits in motor control, trunk stability, and maladaptive pain beliefs (Wells et al., 2012), relatively few studies have directly tested mechanistic pathways. Most trials focus on clinical outcomes (pain and disability), while measures of neuromuscular control, proprioception, or psychosocial mediators are underrepresented. This represents a missed opportunity to clarify how Pilates exerts its effects and to identify which subgroups of patients may derive the most benefit. Future research should therefore incorporate mechanistic outcomes, such as changes in deep trunk muscle activation, fear-avoidance behaviour, or self-efficacy, to link theoretical underpinnings with observed clinical effects.

Several important gaps were identified. Psychosocial outcomes central to contemporary models of low back pain, such as kinesiophobia, fear-avoidance behaviour, and self-efficacy were inconsistently assessed. Reporting of instructor qualifications, screening procedures, and programme progression was often insufficient, limiting replication and clinical translation. Furthermore, few studies examined mechanistic outcomes or long-term follow-up, restricting understanding of how and for whom Pilates may be most beneficial.

4.4. Methodological Limitations

The frequent positioning of Pilates within clinical trials and reviews as an effective exercise option aligns descriptively with international guidelines that recommend active, structured exercise for non-specific low back pain. However, this alignment should be interpreted cautiously. As this review did not assess methodological quality or certainty of evidence, the findings cannot be taken as confirmatory support for guideline recommendations but rather as a reflection of how Pilates is represented and studied within the current evidence base.

The existing evidence base is characterised by significant heterogeneity. Intervention protocols vary widely in frequency, duration, and progression, ranging from six to 12 weeks with one to three sessions per week. Comparator groups are equally diverse, spanning home exercise, education-only, physiotherapy, or other exercise modalities. This variability reduces comparability across studies and contributes to inconsistent findings. Additionally, most trials are limited to short-term follow-up, with only a few extending to six months (da Luz Jr. et al., 2014; Tottoli et al., 2024). Long-term sustainability of Pilates' effects therefore remains uncertain.

Outcome measurement also lacks consistency. While pain and disability are frequently assessed, psychosocial outcomes (e.g., kinesiophobia, fear of movement, work functioning) are less commonly evaluated, despite their recognised importance in chronic LBP. Furthermore, adverse event reporting is rare, though available data suggest Pilates is safe when delivered under professional supervision (Rossetti et al., 2023; Yu et al., 2023).

As a scoping review, this study did not include formal assessment of methodological quality or risk of bias, in accordance with Joanna Briggs Institute and PRISMA-ScR guidance. The purpose of the review was to map the scope, characteristics, and outcome patterns of the existing literature rather than to evaluate intervention effectiveness or certainty of evidence. Consequently, the findings should be interpreted as descriptive and hypothesis-generating.

The absence of quality appraisal limits the ability to draw conclusions regarding the strength or reliability of reported effects. Additionally, heterogeneity in intervention protocols, outcome measures, and follow-up durations constrained meaningful comparison across studies. The predominance of short-term outcomes

further limits insight into the sustainability of reported benefits.

4.5. Clinical Implications

From a clinical perspective, the mapped literature suggests that Pilates is commonly used as a supervised, structured exercise approach for individuals with non-specific LBP. Given the absence of formal evidence grading, clinical implications should be interpreted cautiously. Pilates may be considered a viable option alongside other guideline-endorsed exercise modalities, with decisions guided by patient preference, accessibility, and the availability of appropriately trained instructors.

4.6. Instructor Expertise and Patient Screening for Pilates in Low Back Pain

Appropriate patient selection and instructor expertise are important, yet often underreported, factors influencing the effectiveness of Pilates for LBP. LBP is a heterogeneous condition, and exercise interventions are unlikely to produce uniform benefits across all patient subgroups. As highlighted by Wells et al. (2014), screening is necessary to identify individuals most likely to respond positively to Pilates-based exercise.

Evidence suggests that Pilates may be most suitable for individuals with non-specific LBP who present with low to moderate pain intensity, adequate movement tolerance, and the cognitive capacity to engage with controlled, technique-driven exercise. Patients with severe pain, high levels of fear-avoidance, or significant psychosocial distress may require preliminary interventions—such as education, graded activity, or psychologically informed care—before engaging in Pilates-based programmes (Maher et al., 2017; Hayden et al., 2021).

Instructor training further interacts with patient suitability. Many trials demonstrating positive outcomes involved Pilates delivered or supervised by physiotherapists or clinicians trained in musculoskeletal rehabilitation (da Luz Jr. et al., 2014; Miyamoto et al., 2018). Clinically trained instructors are more likely to conduct appropriate screening, modify exercises based on symptom response, monitor adverse reactions, and integrate pain education. In contrast, community-based Pilates classes led by non-healthcare instructors may be better suited to individuals with resolved or low-risk

LBP, or as a maintenance strategy rather than an initial therapeutic intervention.

Taken together, these findings suggest that Pilates should not be viewed as a one-size-fits-all intervention. Screening for suitability and matching patients to appropriately trained instructors may optimise outcomes, enhance safety, and improve patient experience. Future trials should explicitly report screening criteria and instructor qualifications to clarify how these factors influence treatment effectiveness.

4.7. Role of Instructor Training and Clinical Expertise in Pilates for Low Back Pain

An important consideration that emerges from this review, but is seldom addressed explicitly in the literature, is the level of training and clinical expertise of the Pilates instructor delivering the intervention. Pilates is increasingly offered in diverse settings, ranging from community fitness classes led by non-healthcare professionals to clinically supervised programmes delivered by physiotherapists or other rehabilitation specialists. This distinction may have important implications for both patient outcomes and safety in the context of low LBP.

Several trials included in this review involved Pilates programmes delivered or supervised by physiotherapists or instructors with clinical training in musculoskeletal rehabilitation (da Luz Jr. et al., 2014; Miyamoto et al., 2018; Tottoli et al., 2024). These studies generally incorporated individualised exercise progression, symptom monitoring, and adaptations based on pain response—elements consistent with guideline-based LBP management. In contrast, community-based Pilates classes typically emphasise standardised routines and general fitness goals, which may not adequately address pain mechanisms, fear-avoidance behaviours, or movement impairments common in people with LBP.

Clinical expertise may influence outcomes through several mechanisms. Healthcare-trained instructors are more likely to screen for red flags, tailor exercise selection and dosage, modify movements during symptom exacerbation, and integrate education aligned with contemporary pain science. This is particularly relevant given evidence that psychosocial factors such as kinesiophobia and maladaptive pain beliefs mediate treatment response in chronic LBP (Wells et al., 2014; Maher et al., 2017). Trials incorporating explicit mind–body cueing or pain neuroscience principles—typically

delivered by clinically trained professionals—have demonstrated enhanced reductions in fear of movement and improved patient confidence (Rossetti et al., 2023; Vera-Saura et al., 2024).

Although no randomised trials to date have directly compared Pilates delivered by healthcare professionals versus non-healthcare instructors, indirect evidence suggests that supervision quality and clinical reasoning may be important moderators of effect. Systematic reviews of exercise therapy for LBP consistently report larger effects in programmes that are supervised, individualised, and delivered by trained clinicians compared with unsupervised or generic exercise formats (Hayden et al., 2021). This suggests that the benefits attributed to Pilates may, at least in part, reflect the context and expertise with which it is delivered rather than the exercise modality alone.

From a clinical perspective, these findings imply that individuals with active or persistent LBP may benefit more from Pilates programmes led by instructors with formal healthcare training or specific education in LBP management, particularly in the early stages of rehabilitation. Conversely, community-based Pilates classes may be more appropriate for maintenance, secondary prevention, or individuals with resolved or low-risk symptoms. Future research should explicitly report instructor qualifications and compare delivery models to determine whether clinical training modifies treatment effectiveness, safety, or patient experience.

5. Conclusion

This scoping review aimed to map the breadth of Pilates-based interventions used for LBP, synthesise patterns across reported outcome domains, and identify priorities for future research. The existing literature is characterised by diverse intervention formats and delivery models, with a predominant focus on short-term pain and disability outcomes. Psychosocial measures, mechanistic outcomes, long-term follow-up, and detailed reporting of instructor expertise are inconsistently addressed.

While Pilates is frequently positioned within the literature as a guideline-consistent exercise option for LBP, the absence of methodological quality appraisal in this scoping review precludes definitive conclusions regarding effectiveness or certainty of benefit. Future research should prioritise standardised intervention reporting, broader biopsychosocial outcome assessment, and longer-term evaluation to support more robust

clinical decision-making. Within these limitations, Pilates may be considered one of several acceptable active exercise approaches for low back pain management.

References

- Asik, S., & Sahbaz, S. (2025). The effects of Pilates-based exercise on subacute low back pain: A randomised controlled trial. *Irish Journal of Medical Science*. <https://doi.org/10.1007/s11845-025-03939-y>
- Coelho, L., da Silva, V., & Almeida, M. (2025). High – versus low-intensity Pilates for chronic low back pain: A randomised controlled trial. *Pain Medicine*. <https://pubmed.ncbi.nlm.nih.gov/40122758/>
- da Luz Jr., M. A., Costa, L. O. P., Fuhro, F. F., Manzoni, A. C. T., Oliveira, N. T. B., Cabral, C. M. N., & Costa, L. C. M. (2014). Effectiveness of mat Pilates or equipment-based Pilates in patients with chronic non-specific low back pain: A randomized controlled trial. *Spine*, 39(18), E849–E856. <https://doi.org/10.1097/BRS.0000000000000430>
- Fernández-Rodríguez, R., Álvarez-Bueno, C., Caverro-Redondo, I., Torres-Costoso, A., Reina-Gutiérrez, S., & Martínez-Vizcaíno, V. (2022). Pilates for chronic low back pain: A network meta-analysis. *Pain Physician*, 25(4), E555–E566. <https://pubmed.ncbi.nlm.nih.gov/35722759/>
- Hartvigsen, J., Hancock, M. J., Kongsted, A., Louw, Q., Ferreira, M. L., Genevay, S., ... & Woolf, A. (2018). What low back pain is and why we need to pay attention. *The Lancet*, 391(10137), 2356–2367.
- Hayden, J. A., Wilson, M. N., Stewart, S., Cartwright, J. L., Smith, A. O., Riley, R. D., & van Tulder, M. W. (2021). Exercise treatment effect modifiers in persistent low back pain: An individual participant data meta-analysis of 3,514 participants. *British Journal of Sports Medicine*, 55(21), 1217–24. <https://doi.org/10.1136/bjsports-2020-102626>
- Hoy, D., Bain, C., Williams, G., March, L., Brooks, P., Blyth, F., ... & Buchbinder, R. (2014). A systematic review of the global prevalence of low back pain. *Arthritis & Rheumatology*, 64(6), 2028–37.
- Latey, P. (2001). The Pilates method: History and philosophy. *Journal of Bodywork and Movement Therapies*, 5(4), 275–282.
- Maher, C., Underwood, M., & Buchbinder, R. (2017). Non-specific low back pain. *The Lancet*, 389(10070), 736–747.
- Miyamoto, G. C., Costa, L. O. P., Cabral, C. M. N., Eyles, J. P., & Costa, L. C. M. (2018). Different doses of Pilates-based exercise therapy for chronic low back pain: A randomized controlled trial with economic evaluation. *Pain*, 159(3), 601–609. <https://doi.org/10.1097/j.pain.0000000000001127>
- Munn, Z., Peters, M. D., Stern, C., Tufanaru, C., McArthur, A., & Aromataris, E. (2018). Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. *BMC Medical Research Methodology*, 18(1), 143.
- National Institute for Health and Care Excellence. (2016). *Low back pain and sciatica in over 16s: Assessment and management (NICE guideline [NG59])*. NICE. <https://www.nice.org.uk/guidance/ng59>
- Patti, A., Bianco, A., Paoli, A., Messina, G., Montalto, M. A., Bellafore, M., & Palma, A. (2015). Effects of Pilates exercise programs in people with chronic low back pain: A systematic review. *Medicine*, 94(4), e383. <https://doi.org/10.1097/MD.0000000000000383>
- Patti, A., Zangla, D., Cataldi, S., Messina, G., & Palma, A. (2024). The effects of Pilates exercise in individuals with low back pain: A systematic review and meta-analysis. *Journal of Back and Musculoskeletal Rehabilitation*, 37(2), 295–310. <https://doi.org/10.3233/BMR-230327>
- Peters, M. D. J., Marnie, C., Tricco, A. C., Pollock, D., Munn, Z., Alexander, L., ... & Khalil, H. (2020). Updated methodological guidance for the conduct of scoping reviews. *JBIM Evidence Synthesis*, 18(10), 2119–26.
- Qaseem, A., Wilt, T. J., McLean, R. M., & Forciea, M. A. (2017). Noninvasive treatments for acute, subacute, and chronic low back pain: A clinical practice guideline from the American College of Physicians. *Annals of Internal Medicine*, 166(7), 514–530. <https://doi.org/10.7326/M16-2367>
- Rossetti, R. L., Umpierre, D., Ribeiro, P. A. B., Silveira, J. M., Teixeira, B. C., & Sbruzzi, G. (2023). Pain neuroscience education and Pilates for elderly with chronic low back pain: A randomized controlled trial. *Acta Paulista de Enfermagem*, 36(eAPEo3772). <https://doi.org/10.37689/acta-ape/2023a003772>
- Stieglitz, E., Mazaheri, M., & Noormohammadpour, P. (2016). Equipment-based Pilates versus physiotherapy programmes for workers with chronic low back pain: A randomised trial. *Physiotherapy Research International*, 21(4), 236–244. <https://doi.org/10.1016/j.physio.2015.08.001>
- Tottoli, C. R., et al. (2024). Effects of mat Pilates on pain, disability, and health-related quality of life in adults with chronic non-specific low back pain: A

- randomised controlled trial. *Journal of Rehabilitation Medicine*, 56(5), jrm00234. <https://pubmed.ncbi.nlm.nih.gov/39275840/>
- Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K. K., Colquhoun, H., Levac, D., ... & Straus, S. E. (2018). PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. *Annals of Internal Medicine*, 169(7), 467–473.
- Vera-Saura, J., Hernández-Sánchez, S., & Cuesta-Vargas, A. (2024). Mind–body cueing enhances the effects of Pilates in individuals with chronic low back pain: A double-blind randomised controlled trial. *Journal of Clinical Medicine*, 13(16), 4731. <https://doi.org/10.3390/jcm13164731>
- Vos, T., Lim, S. S., Abbafati, C., Abbas, K. M., Abbasi, M., Abbasifard, M., ... & Murray, C. J. (2020). Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: A systematic analysis for the Global Burden of Disease Study 2019. *The Lancet*, 396(10258), 1204–22.
- Wells, C., Kolt, G. S., Marshall, P., Hill, B., & Bialocerkowski, A. (2012). Effectiveness of Pilates exercise in treating people with chronic low back pain: A systematic review of systematic reviews. *BMC Medical Research Methodology*, 12(7), 1–12. <https://doi.org/10.1186/1471-2288-12-7>
- Wells, C., Kolt, G. S., Marshall, P., & Bialocerkowski, A. (2014). Indications, benefits, and risks of Pilates exercise for people with chronic low back pain: A Delphi survey of Pilates-trained physiotherapists. *Physical Therapy*, 94(6), 806–817. <https://doi.org/10.2522/ptj.20130568>
- Yu, C., Chen, L., & Wu, Y. (2023). Pilates exercise for chronic low back pain: A systematic review and meta-analysis. *International Journal of Environmental Research and Public Health*, 20(4), 2850. <https://doi.org/10.3390/ijerph20042850>

Review Article

Neuromuscular Electrical Stimulation in Respiratory Conditions: A Systematic Review

Randall Debattista

Department of Physiotherapy, Faculty of Health Sciences, University of Malta, Msida, Malta

Tonio Agius

Department of Physiotherapy, Faculty of Health Sciences, University of Malta, Msida, Malta

Anabel Sciriha

Department of Physiotherapy, Faculty of Health Sciences, University of Malta, Msida, Malta

Abstract

Neuromuscular Electrical Stimulation (NMES) has emerged as a promising adjunctive intervention in the management of respiratory conditions, particularly chronic obstructive pulmonary disease, where skeletal muscle dysfunction contributes to reduced functional capacity and poor quality of life. This systematic review synthesises evidence on Neuro Muscular Electrical Stimulation applications in both acute and chronic respiratory contexts, focusing on its effects on peripheral muscle strength, exercise tolerance, pulmonary function, and health-related quality of life. A structured literature search was conducted across PubMed, Google Scholar and MEDLINE and CINAHL accessed via the HyDi platform, covering publications from inception to 2025. In PubMed, both Medical Subject Headings (MeSH) and free-text terms were used, while database-specific subject headings and keywords were adapted for MEDLINE and CINAHL. Eligible studies included randomised controlled trials, systematic reviews, and meta-analyses investigating NMES in patients with COPD, acute exacerbations, or critical illness. A total of 61 articles were reviewed from which 5 were chosen. Key outcomes extracted included muscle strength, exercise capacity,

pulmonary function indices, Health Related Quality of Life, and adverse events. Methodological quality and risk of bias were critically appraised to contextualise findings. Synthesis of the included meta-analyses demonstrated that NMES yields significant improvements in peripheral muscle function and functional capacity. Pooled results indicated a statistically significant increase in the six-minute walk distance (6MWD) of approximately 35–40 m following NMES compared with control interventions and a marked enhancement in quadriceps force production, particularly in severely deconditioned patients. Furthermore, systematic review data confirmed clinically meaningful improvements in health-related quality of life (HRQoL) and a reduction in exertional dyspnoea. A methodological appraisal via AMSTAR-II revealed high confidence in the systematic reviews, although the absence of pre-registered protocols was noted as a minor methodological deficit. NMES represents a safe and feasible adjunct to pulmonary rehabilitation and critical care, particularly for patients unable to engage in conventional exercise training. Nevertheless, long-term effectiveness, cost-effectiveness, and patient-centered outcomes remain underexplored. Future research should focus on protocol standardisation, integration with wearable and tele-rehabilitation technologies, and robust multicenter trials to clarify its role in routine respiratory rehabilitation.

Keywords: Neuromuscular Electrical Stimulation, COPD, Respiratory Rehabilitation, Physiotherapy, Acute Exacerbations, Pulmonary Function

Correspondence to Randall Debattista

randalldebattista@gmail.com

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1. Introduction

Respiratory conditions such as Chronic Obstructive Pulmonary Disease (COPD) are not solely confined to pulmonary pathology but also entail systemic consequences, particularly skeletal muscle dysfunction (Gong et al., 2018). Peripheral muscle atrophy and weakness contribute significantly to decreased exercise tolerance, poor HRQoL, and increased morbidity. Pulmonary rehabilitation (PR), a cornerstone in the management of COPD, includes exercise training to mitigate these effects. However, individuals with advanced disease or acute exacerbations often struggle to engage in conventional rehabilitation due to severe dyspnoea, fatigue, or hospitalisation (Alves et al., 2022).

The chronic systemic inflammation, oxidative stress, and physical inactivity associated with COPD exacerbate muscular deterioration, particularly in the lower limbs. The resulting inactivity-induced atrophy and fibre-type shifts further compromise patient mobility.

NMES involves the application of transcutaneous electrical current to a muscle or group of muscles via surface electrodes, typically positioned over the motor points to maximise recruitment efficiency (Lake, 1992). Unlike volitional exercise, which follows Henneman's size principle by recruiting small, fatigue-resistant Type I fibres first, NMES induces a non-selective, synchronous recruitment of both Type I and fast-twitch Type II motor units (Gregory & Bickel, 2005).

The clinical effects of NMES are influenced by several adjustable stimulation parameters that define the intervention protocol: Pulse Frequency which is typically set between 30–50 Hz to achieve a tetanic contraction necessary for strength gains (Maffiuletti, 2010); Pulse Width (Duration): Usually ranging from 200 to 450 microseconds, which determines the depth of axonal recruitment and patient comfort (Gorgey et al., 2006) and Current Intensity: Measured in milliamperes (mA) and titrated to a visible, strong muscle contraction or the maximum tolerable level for the patient.

By bypassing the need for voluntary effort and central nervous system activation, NMES allows for targeted peripheral muscle conditioning without imposing a substantial cardiopulmonary load, thus offering a viable intervention for severely deconditioned patients (Sillen et al., 2009). This review aims to synthesise and appraise the methodological quality of existing evidence for NMES in both stable and acute respiratory phases,

examining the translation of these specific electrical parameters into clinical functional outcomes.

2. Methods

2.1. Eligibility Criteria

This systematic review included studies investigating the effects of NMES in individuals with respiratory conditions, including chronic obstructive pulmonary disease (COPD), acute exacerbations of respiratory disease, and critical illness. Eligible study designs comprised randomised controlled trials (RCTs), systematic reviews, meta-analyses, and network meta-analyses involving human participants. Outcomes of interest included peripheral muscle strength, exercise capacity (e.g., six-minute walk distance), pulmonary function, HRQoL, and safety or adverse events related to NMES use.

From the eligible literature, five articles were selected based on predefined criteria prioritising methodological rigour, relevance to respiratory populations, and contribution to clinical interpretability. Three articles were systematic reviews or meta-analyses with high or moderate methodological confidence as assessed using AMSTAR-II, ensuring synthesis of the highest level of available evidence. Two randomised controlled trials were additionally included to provide detailed reporting of NMES intervention parameters and patient-level clinical outcomes that were not consistently extractable from pooled analyses. These trials were selected because they represented key early investigations in COPD populations and offered clinically relevant insights into feasibility, dosing, and implementation. Articles were excluded at this stage if they demonstrated substantial methodological limitations, duplicated evidence without added value, or lacked sufficient outcome reporting.

Studies were excluded if they were not published in English, involved animal models, consisted solely of conference abstracts without full-text availability, or were narrative reviews lacking a systematic search strategy.

2.2. Information Sources

A structured literature search was conducted across the following electronic databases: PubMed, Google Scholar, and Medline and Cinahl through the HyDi platform. The search included all eligible studies published from database inception to January 2025. Reference lists of

included systematic reviews and meta-analyses were also screened to identify additional relevant studies not captured in the initial search.

2.3. Search Strategy

The search strategy combined controlled vocabulary and free-text terms related to NMES and respiratory disease. The following keywords and Boolean operators were used: ("Neuromuscular Electrical Stimulation" OR "NMES") AND ("COPD" OR "Chronic Obstructive Pulmonary Disease" OR "Respiratory" OR "Critical Illness" OR "Acute Exacerbation") AND ("Muscle Strength" OR "Exercise Capacity" OR "Pulmonary Function" OR "Rehabilitation" OR "Quality of Life"). The search terms were adapted as necessary for each database to optimise sensitivity (Appendix 1).

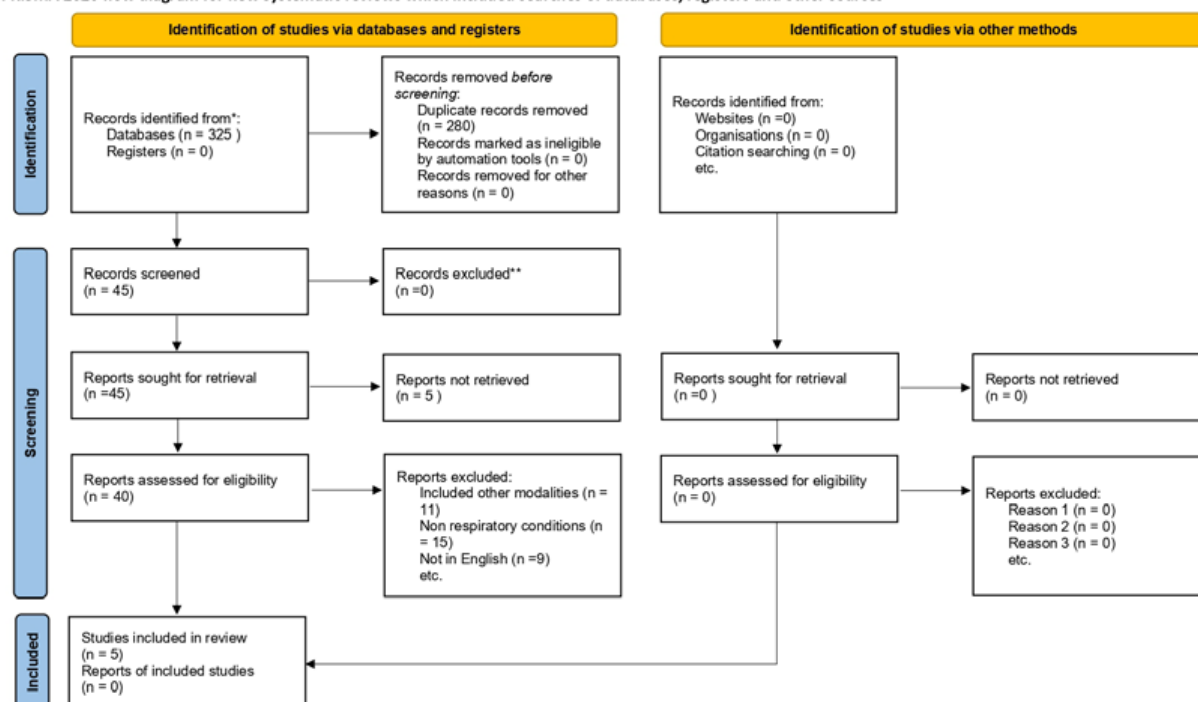
2.4. Data Synthesis

Due to heterogeneity in study populations, NMES protocols, outcome measures, and the presence of overlapping primary studies across systematic reviews, a quantitative meta-analysis was not undertaken. Instead, evidence was synthesised narratively, with systematic reviews serving as the primary source of effect estimates and selected RCTs contributing detailed contextual and protocol-level insights. This approach was adopted to maximise interpretability while minimising methodological redundancy.

This systematic review included studies that investigated the use of NMES in individuals with respiratory conditions, including chronic obstructive pulmonary disease (COPD), acute exacerbations of respiratory disease, and critical illness. Eligible study designs comprised RCTs, systematic reviews, meta-analyses, and network meta-analyses involving human participants. Outcomes of interest included peripheral muscle strength, exercise capacity, pulmonary function, HRQoL, and safety or adverse events related to NMES use.

Studies were excluded if they were not published in English, involved animal models, consisted solely of conference abstracts without full-text availability, or were narrative reviews without a systematic search strategy.

PRISMA 2020 flow diagram for new systematic reviews which included searches of databases, registers and other sources



*Consider, if feasible to do so, reporting the number of records identified from each database or register searched (rather than the total number across all databases/registers).

**If automation tools were used, indicate how many records were excluded by a human and how many were excluded by automation tools.

Source: Page MJ, et al. BMJ 2021;372:n71. doi: 10.1136/bmj.n71.

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Figure 1. PRISMA 2020 flow diagram outlining study identification, screening, eligibility, and inclusion

2.5. Rationale for Inclusion of Primary Randomised Controlled Trials

Although the two included randomised controlled trials (Kucio et al., 2016; Vivodtzev et al., 2006) were published prior to the identified systematic reviews, they were deliberately retained for explicit appraisal for methodological and clinical reasons. Specifically, these trials provided detailed reporting of NMES intervention parameters (e.g., stimulation frequency, pulse width, session duration, electrode placement, and progression), implementation context, and patient-level clinical outcomes that were either incompletely reported, aggregated, or not consistently extractable from the systematic reviews.

The purpose of including these RCTs was not to re-estimate pooled treatment effects or to duplicate evidence already synthesised in the systematic reviews, but rather to enhance clinical interpretability, contextualise protocol heterogeneity, and support

mechanistic understanding of NMES application in respiratory populations. Accordingly, the RCTs were discussed narratively and not combined quantitatively with findings from the systematic reviews.

2.6. Assessment of Overlap Between Systematic Reviews

To address potential redundancy, the primary studies included within the three systematic reviews (Alves et al., 2022; Gong et al., 2018; Zhang et al., 2024) were examined for overlap. Substantial overlap was identified between the two COPD-focused reviews (Alves et al., 2022; Gong et al., 2018), reflecting the limited pool of early NMES trials in stable COPD populations. In contrast, minimal overlap was observed between these reviews and the network meta-analysis by Zhang et al. (2024), which focused on critically ill, mechanically ventilated patients in intensive care settings.

Given this overlap, findings were synthesised narratively rather than quantitatively, and conclusions were interpreted with attention to differences in review scope, population, and outcome focus to minimise double-counting of evidence.

2.7. Screening and Data Collection

Study selection was performed in two stages. First, two reviewers independently screened titles and abstracts for potential eligibility. Second, full-text articles of potentially relevant studies were retrieved and assessed against the predefined eligibility criteria. Any disagreements during screening were resolved through discussion and consensus.

For each included study, data were extracted using a standardised approach. Extracted information included study design, population characteristics, sample size, NMES intervention parameters (including frequency, pulse duration, duty cycle, electrode placement, and intervention duration), comparator interventions where applicable, and reported outcomes.

2.8. Risk of Bias Assessment

Methodological quality and risk of bias were assessed to contextualise the findings of the included studies. They were independently assessed by the review authors and were not extracted from the conclusions of the included systematic reviews.

To ensure a rigorous evaluation of the included evidence, different appraisal tools were utilised based on study design. The methodological quality of the three included systematic reviews (Alves et al., 2022; Gong et al., 2018; Zhang et al., 2024) was appraised using the AMSTAR-II (A MeaSurement Tool to Assess systematic Reviews) tool. AMSTAR-II was selected as it is specifically designed to assess the quality of systematic reviews that include randomised or non-randomised trials of healthcare interventions, focusing on critical domains such as protocol registration and search comprehensiveness.

For the RCTs, the Cochrane Risk of Bias tool was employed to assess internal validity across domains, including sequence generation, allocation concealment, blinding of participants and personnel, incomplete outcome data, and selective reporting. The results of the risk of bias assessment for the RCTs are presented in Figure 2.

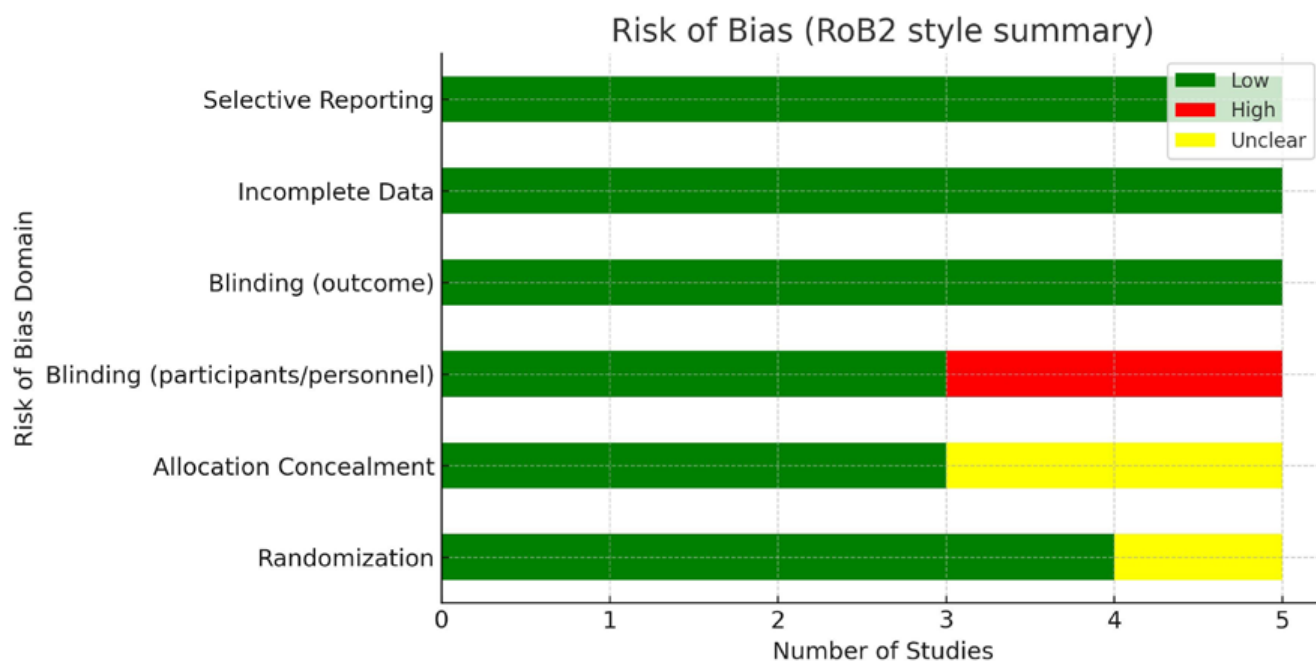


Figure 2. Risk of bias assessment of included randomised controlled trials using the Cochrane Risk of Bias 2 tool. A single consolidated plot is presented due to similar risk-of-bias judgments across outcomes

3. Results

Five studies met the eligibility criteria and were included in this review, comprising three systematic reviews and meta-analyses and two randomised controlled trials. The

characteristics of the included studies are summarised in Table 1.

Table 1: Table of articles analysed for this systematic review

Author (Year)	Design	Population	Databases & Search Span	No. of RCTs Included	Total Participants (approx.)	Intervention / Comparators	Key Outcomes
Gong et al. (2018)	Systematic review & meta-analysis	Stable COPD	PubMed, EMBASE, Cochrane Library; inception –2017	11 RCTs	~350–400 COPD patients	NMES vs usual care or sham	↑ 6MWD (~35–40 m), ↑ quadriceps strength
Alves et al. (2022)	Systematic review & meta-analysis (GRADE)	Stable COPD	PubMed, MEDLINE, CINAHL, PEDro; inception –2021	14 RCTs	~500 COPD patients	NMES vs control / PR	↑ muscle strength, ↑ exercise capacity; variable HRQoL
Zhang et al. (2024)	Network meta-analysis	Critically ill, mechanically ventilated adults	PubMed, EMBASE, Web of Science; inception –2023	18 RCTs	~1,200 ICU patients	NMES, usual care, passive physiotherapy, early mobilisation	↓ muscle atrophy, ↑ extubation success
Vivodtzev et al. (2006)	RCT	Severely deconditioned COPD	—	1 RCT	n = 30	NMES vs usual care	↑ quadriceps strength, ↓ dyspnoea
Kucio et al. (2016)	RCT	COPD	—	1 RCT	n = 30	NMES + PR vs PR alone	↑ exercise tolerance

3.1. Study Selection and Evidence Base

Three systematic reviews and meta-analyses (Alves et al., 2022; Gong et al., 2018; Zhang et al., 2024) and two randomised controlled trials (Kucio et al., 2016; Vivodtzev et al., 2006) met the eligibility criteria and were included in this review. The systematic reviews collectively synthesised evidence from stable COPD populations and critically ill, mechanically ventilated patients, whereas the RCTs provided detailed protocol-level data on NMES application in COPD. Gong et al. (2018) reported a pooled mean difference in six-minute

walk distance of approximately 35–40 m favouring NMES compared with control, alongside significant improvements in quadriceps strength. Alves et al. (2022) similarly demonstrated pooled improvements in lower-limb muscle strength and exercise capacity, with smaller and more variable effects observed for health-related quality of life outcomes. The observed improvement in 6MWD (approximately 35–40 m) meets or exceeds commonly reported minimum clinically important differences (MCID) for COPD populations ($\approx$ 25–30 m), suggesting that gains in exercise capacity are likely

to be clinically meaningful. In contrast, MCIDs for HRQoL outcomes were not consistently met, which may explain the variable findings across studies. Considerable heterogeneity was observed across pooled analyses, with reported I^2 values ranging from approximately 60% to 80% for outcomes such as six-minute walk distance and quadriceps strength, indicating substantial between-study variability.

3.2. Critical Appraisal of Systematic Reviews

Methodological quality of the three systematic reviews was assessed using the AMSTAR-II tool, with results summarised in Table 2.

Table 2: Methodological quality of the three systematic reviews was assessed using the AMSTAR-II tool

AMSTAR-II Critical Domain	Gong et al. (2018)	Alves et al. (2022)	Zhang et al. (2024)	Explanation
Protocol registered prior to review (Item 2)	No	No	No	None of the reviews reported PROSPERO or equivalent registration
Comprehensive literature search (Item 4)	Yes	Yes	Yes	Multiple databases searched with reproducible strategies
Justification for excluded studies (Item 7)	Partial	Yes	Partial	Alves et al. provided explicit exclusion lists; others did not fully report exclusions
Risk of bias assessed in primary studies (Item 9)	Yes	Yes	Partial	Zhang et al. reported RoB but with limited integration
Appropriate meta-analytical methods (Item 11)	Yes	Yes	Yes	Fixed/random effects appropriately selected
Consideration of RoB in interpretation (Item 13)	Yes	Yes	Partial	Limited discussion of bias impact in ICU network meta-analysis
Assessment of publication bias (Item 15)	Yes	Yes	No	Funnel plots not feasible or not reported in Zhang et al.
Overall AMSTAR-II confidence	High	High	Moderate	Moderate rating driven by heterogeneity and incomplete bias integration

Gong et al. (2018) who conducted a pairwise meta-analysis examining the effects of NMES with usual care or sham interventions in COPD populations, and Alves et al. (2022) were both rated as high confidence. The certainty of evidence in the systematic review by Alves et al. (2022) was formally assessed using the GRADE approach, with evidence for muscle strength and exercise capacity outcomes rated as moderate quality, primarily downgraded due to small sample sizes and risk of performance bias. Reliable improvements in peripheral muscle strength following NMES have been demonstrated across multiple studies, including the meta-analyses by Gong et al. (2018) and Alves et al. (2022), both of which reported significant pooled increases in

quadriceps strength. These findings are further supported by randomised controlled trials by Vivodtzev et al. (2006) and Kucio et al. (2016), which demonstrated significant improvements in lower-limb muscle force following NMES interventions. Both Gong et al. (2018) and Alves et al. (2022) undertook subgroup and sensitivity analyses exploring sources of heterogeneity, including disease severity, intervention duration, and NMES protocol characteristics. However, formal subgroup analyses based on stimulation frequency, pulse duration, or intensity were limited by inconsistent reporting across primary trials and did not fully account for observed heterogeneity.

These reviews demonstrated comprehensive literature searches, appropriate meta-analytical methods, and explicit assessment of risk of bias in included trials. Although neither review reported prior protocol registration, this limitation did not substantially compromise confidence given the robustness of other critical domains. Both reviews incorporated risk of bias considerations into their interpretation of results and assessed potential publication bias. The principal risks of bias across the primary evidence were identified as high performance bias due to the inability to blind participants to the intervention, and moderate selection bias stemming from unclear allocation concealment and small sample sizes ($n \approx 30$) in individual trials. Most primary randomised controlled trials included in the review did not report a priori sample size calculations, reflecting feasibility-driven recruitment rather than formal power justification. Consequently, while NMES is an effective adjunctive therapy, the overall certainty of evidence for long-term functional recovery is considered moderate.

The network meta-analysis by Zhang et al. (2024) was rated as moderate confidence. While the statistical methodology was rigorous and appropriate for comparative effectiveness analysis, several methodological concerns reduced overall confidence. A frequentist framework was employed, with treatment ranking generated using P-scores. These included high clinical heterogeneity across ICU populations, incomplete consideration of primary study risk of bias in the interpretation of findings, and the absence of formal publication bias assessment. These limitations necessitate cautious interpretation of comparative effect estimates in critically ill populations.

3.3. Overlap of Primary Studies Across Reviews

Substantial overlap of primary trials was identified between the two COPD-focused systematic reviews (Alves et al., 2022; Gong et al., 2018), reflecting the relatively small pool of NMES trials in stable COPD. In contrast, minimal overlap existed between these reviews and the ICU-focused network meta-analysis by Zhang et al. (2024), which included a distinct set of mechanically ventilated patients. To minimise the risk of double-counting evidence, findings were synthesised narratively, and no attempt was made to aggregate effect sizes across reviews.

3.4. Synthesis of Clinical Effects

The included meta-analyses synthesised data from approximately 8–14 randomised controlled trials, encompassing between 250 and 600 participants, depending on outcome and population.

Across high-confidence systematic reviews, NMES was consistently associated with significant improvements in peripheral muscle strength, particularly quadriceps force, and exercise capacity in COPD patients. Gong et al. (2018) reported a statistically and clinically meaningful improvement in six-minute walk distance following NMES interventions. Alves et al. (2022) further demonstrated improvements in health-related quality of life, notably in fatigue and dyspnoea domains.

In critically ill populations, Zhang et al. (2024) reported that NMES mitigated muscle atrophy and improved short-term outcomes such as extubation success, with relative improvements of approximately 10–15%, confidence intervals were wide; however, effects on long-term functional recovery remained uncertain due to heterogeneity and moderate methodological confidence.

Patient compliance and acceptability of NMES were generally reported as high across the included studies. Systematic reviews indicated good adherence to NMES protocols, with low withdrawal rates and minimal adverse events, primarily limited to transient discomfort or mild skin irritation. Across meta-analyses and randomised controlled trials, NMES was well tolerated, with adverse events reported as infrequent and mild. Gong et al. (2018) and Alves et al. (2022) reported no serious intervention-related adverse events, with occasional transient muscle soreness or minor skin irritation at electrode sites. Similarly, Vivodtzev et al. (2006) and Kucio et al. (2016) reported high adherence and no NMES-related withdrawals.

In COPD populations, NMES was well tolerated even in severely deconditioned individuals who were unable to participate fully in conventional exercise training. The included RCTs further demonstrated that stimulation intensity could be progressively increased to achieve visible muscle contraction without compromising patient comfort, suggesting good acceptability when protocols are individualised. In critically ill and mechanically ventilated patients, NMES was feasible to implement in ICU settings, with studies reporting high session completion rates and no serious intervention-related complications.

In contrast, effects on health-related quality of life were inconsistent, with pooled analyses demonstrating small effect sizes and several outcomes failing to reach statistical significance, particularly when measured using generic instruments such as the SF-36. The inconsistent effects of NMES on HRQoL across studies may be explained by several factors. First, substantial heterogeneity exists in the HRQoL instruments used (e.g., SGRQ, CRQ, SF-36), which differ in sensitivity to short-term functional changes. Second, intervention duration in many trials was relatively short, potentially insufficient to translate improvements in muscle strength or exercise capacity into perceptible changes in daily functioning and well-being. Third, baseline disease severity varied widely, and patients with advanced COPD or critical illness may prioritise symptom relief over broader quality-of-life domains. Finally, improvements in peripheral muscle function do not necessarily correspond immediately to psychosocial or emotional domains of HRQoL, which are influenced by comorbidities, psychological status, and social factors not directly targeted by NMES.

3.5. Contribution of Primary Randomised Controlled Trials

The two included RCTs were discussed narratively to contextualise NMES application and protocol variability. Vivodtzev et al. (2006) demonstrated improvements in quadriceps strength and dyspnoea during daily activities in severely deconditioned COPD patients, while Kucio et al. (2016) showed that NMES combined with pulmonary rehabilitation enhanced exercise tolerance beyond rehabilitation alone. These trials did not contribute additional effect estimates but provided clinically relevant detail regarding stimulation parameters and feasibility that was incompletely reported in the systematic reviews.

4. Limitations

This review has several limitations. First, it included both systematic reviews and selected primary RCTs, which introduces the potential for overlap of evidence. While the primary RCTs predated the included systematic reviews, their inclusion was intentional and limited to narrative discussion to provide detailed insight into NMES protocol characteristics and clinical implementation that were not consistently reported in pooled analyses. No additional effect estimation or weighting was derived from these trials.

Second, overlap of primary studies across the systematic reviews, particularly between the COPD-focused reviews, was present and reflects the constrained evidence base in this field. To mitigate the risk of double-counting, findings were synthesised narratively, and no attempt was made to aggregate results across reviews.

Third, heterogeneity in NMES parameters, intervention duration, outcome measures, and patient characteristics limits the generalisability of conclusions and precludes quantitative synthesis. Finally, many primary studies were limited by small sample sizes and an inherent inability to blind participants to NMES interventions, contributing to moderate risk of bias.

5. Conclusion

NMES offers a compelling adjunctive strategy in the management of respiratory diseases, particularly for patients with limited ability to engage in traditional exercise. While evidence supports its role in enhancing muscle strength and functional capacity, particularly in COPD, its effects on HRQoL, pulmonary function, and long-term outcomes are less clear. Considerable variability in study protocols, small sample sizes, and short intervention durations limit definitive conclusions.

Future research must focus on protocol standardisation, long-term effectiveness, patient-centered outcomes, and integration of emerging technologies. Cost-effectiveness and real-world implementation strategies must also be addressed. Until such evidence is available, NMES should be considered a supplementary tool within comprehensive rehabilitation frameworks, best suited to carefully selected patient populations.

References

- Alves, I.G.N., da Silva E Silva, C.M., Martinez, B.P., de Queiroz, R.S., & Gomes-Neto, M. (2022). Effects of neuromuscular electrical stimulation on exercise capacity, muscle strength and quality of life in COPD patients: A systematic review with meta-analysis. *Clinical Rehabilitation*, 36(1), 3–13.
- Gong, W., et al. (2018). Neuromuscular electrical stimulation improves exercise capacity in adult patients with chronic lung disease: a meta-analysis of English studies. *Journal of Thoracic Disease*, 10(6), 3531–3541.

- Gorgey, A. S., Mahoney, E., Kendall, T., & Dudley, G. A. (2006). Effects of neuromuscular electrical stimulation parameters on specific tension. *European Journal of Applied Physiology*, 97(6), 737–744. <https://doi.org/10.1007/s00421-006-0232-7>
- Gregory, C. M., & Bickel, C. S. (2005). Recruitment patterns in human skeletal muscle during electrical stimulation. *Physical therapy*, 85(4), 358–364.
- Kucio, C., Niesporek, J., Kucio, E., Narloch, D., & Węgrzyn, B. (2016). Evaluation of the Effects of Neuromuscular Electrical Stimulation of The Lower Limbs Combined with Pulmonary Rehabilitation on Exercise Tolerance in Patients with Chronic Obstructive Pulmonary Disease. *Journal of Human Kinetics*, 54, 75–82.
- Lake D. A. (1992). Neuromuscular electrical stimulation. An overview and its application in the treatment of sports injuries. *Sports Medicine*, May;13(5):320–36. doi:10.2165/00007256-199213050-00003. PMID: 1565927
- Maffiuletti, N. A., & Maffiuletti, N. T. N. A. (2010). Physiological and methodological considerations for the use of neuromuscular electrical stimulation Springer Science and Business Media LLC. doi:10.1007/s00421-010-1502-y
- Sillen, M., Speksnijder, C., Eterman, R., Janssen, P., Wagers, S., Wouters, E., Uszko-Lencer, N., & Spruit, M. (2009). Effects of neuromuscular electrical stimulation of muscles of ambulation in patients with chronic heart failure or COPD: a systematic review of the English-language literature. Database of Abstracts of Reviews of Effects (DARE): Quality-assessed Reviews - NCBI Bookshelf. <https://www.ncbi.nlm.nih.gov/books/NBK77485/>
- Vivodtzev, I., Pépin, J.L., Vottero, G., Mayer, V., Lévy, P., & Wuyam, B. (2006). Improvement in quadriceps strength and dyspnea in daily tasks after 1 month of electrical stimulation in severely deconditioned and malnourished COPD. *Chest*, 129(6), 1540–1548.
- Zhang, Y., et al. (2024). Effect of neuromuscular electrical stimulation in critically ill adults with mechanical ventilation: a systematic review and network meta-analysis. *Critical Care*, 28(1), 45.

AND

("Pulmonary Disease, Chronic Obstructive"[MeSH] OR COPD OR "chronic lung disease" OR respiratory)

AND

("Muscle Strength"[MeSH] OR "Exercise Tolerance"[MeSH] OR "Quality of Life"[MeSH] OR rehabilitation)

MEDLINE (via HyDi):

(Neuromuscular Electrical Stimulation OR NMES) AND (COPD OR chronic obstructive pulmonary disease OR respiratory disease) AND (muscle strength OR exercise capacity OR rehabilitation OR quality of life)

CINAHL (via HyDi):

(MH "Neuromuscular Electrical Stimulation" OR NMES) AND (MH "Pulmonary Disease, Chronic Obstructive" OR COPD) AND (exercise tolerance OR muscle strength OR quality of life)

Google Scholar:

"neuromuscular electrical stimulation" AND COPD AND rehabilitation

Appendix 1. Database-Specific Search Strategies

PubMed search strategy (MeSH + free text):

("Neuromuscular Electrical Stimulation"[MeSH] OR "neuromuscular electrical stimulation" OR NMES)

Research Article

Academic Emotions in University Students: A Comparative Study

Victor Martinelli

Department of Education Studies, Faculty of Education, University of Malta, Msida

Abstract

Research highlights the impact of achievement emotions on learners' motivation and learning, demonstrating that emotions play a pivotal role in shaping students' academic performance. This study evaluated the use of an emotions assessment tool, initially developed in a Canadian university setting, in a similar university setting in Malta. We employed the Achievement Emotions Questionnaire (AEQ-S) short version (Bieleke et al., 2021) to gauge students' emotions in academic settings. The means of the Maltese students were comparable to those of the Canadian reference group, and a Principal Components Analysis consistently identified the same two groups of emotion components across all three questionnaire contexts. In this study, 156 undergraduate students attending a tertiary-level institution completed the AEQ-S online. Respondents' scores were compared to those of a first and a second reference group using t-tests. The structure of responses was further analysed using principal component analysis. Although not dissimilar, respondents' emotion scores were stronger ($p < 0.05$) than those of the reference samples in most contexts. These analyses provide insight into the use of this tool in the specific setting in which it was applied and suggest that further investigation is advisable.

Keywords: achievement emotions, university students, assessment, Control-Value theory

Correspondence to Victor Martinelli

victor.martinelli@um.edu.mt

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1. Academic Emotions in University Students: A Comparative Study

Emotions influence “perception, attention, learning, memory, reasoning, and problem solving...especially modulating the selectivity of attention as well as motivating action and behavior” (Tyng et al., 2017, p. 1). The time students spend following tertiary studies can be characterised by highly charged emotional states (Lipson et al., 2022). The term ‘academic emotions’ (Pekrun et al., 2002) encapsulates the emotional experiences directly linked to learning, instruction, and performance. This study addresses a geographic gap in the validation of a research instrument that measures university students' achievement emotions. Beyond being geographically under-studied, Maltese undergraduate students typically enjoy strong familial support and live at home throughout their studies. Extended family ties are strong, and university education is free at the undergraduate level (Vella & Cassar, 2022). This cultural context may possess its own particularity.

1.1. Achievement and the Control-Value theory of achievement emotions

Since education provides students with opportunities for critical thinking, reasoning, and problem-solving, it is essential to consider how emotions moderate achievement outcomes. For example, does the ability to respond effectively to academic pressures and setbacks (Putwain et al., 2023) provide a buffer against negative emotions detrimental to learning (boredom and anxiety)? Emotions are integral to the learning and achievement cycle; the two cannot be separated.

In the context of learning environments such as universities, the ‘Control-Value Theory’ (Pekrun, 2006), commonly referred to as CVT, provides a valuable framework for exploring student characteristics in these

settings. Accordingly, achievement emotions depend on individuals' judgments of their control over events and the value ascribed to outcomes (Riegel & Evans, 2021). This theory considers various achievement emotions and their influence on the cognitive and motivational processes that underpin performance and academic achievement. While the core framework of this theory has been applied across German and Canadian contexts, empirical validation remains necessary, given that cultural values, educational systems, and study styles vary across countries and cultures. Collectivist cultures may perceive student autonomy and achievement differently from individualistic cultures, holding implications for how students perceive control and value.

The control value theory proposes that when learners perceive they have or lose control over a learning situation, the subjective value they attach to the experience elicits emotions. When the outcome is desirable, they gain academic control. This is so when the outcome is controllable, as in Weiner's (1985) attribution theory, and of value to the learner, hence the term control-value system (Pekrun et al., 2011). While positive activating emotions contribute to cognitive reserve and direct students' attention toward the learning goal, negative deactivating emotions demotivate students from allocating their cognitive resources to the learning

task. This undermines motivation and promotes shallow information processing.

While moderate levels of stress can facilitate learning and optimise memory processing (Joëls et al., 2006; Vogel & Schwabe, 2016), high levels of stress impair attention and motivation, thereby affecting learning, memory, and ultimately performance (Putwain et al., 2022). Pekrun et al. (2002) sought to identify the structure of positive emotions, their measurement, their impact on student health, and how positive academic emotions could be fostered to help students avoid negative emotions when they are expressed.

2. The Achievement Emotions Questionnaire

The Achievement Emotions Questionnaire (AEQ) (Pekrun et al., 2005) employs a multidimensional framework to assess emotions related to class, learning, and testing. While high control and high value link to positive emotions like enjoyment, low control combined with high value often leads to negative emotions like anxiety. Pekrun et al.'s (2011) CVT is shown in Figure 1 below. It depicts the structural organisation of emotion operationalised in empirical research.

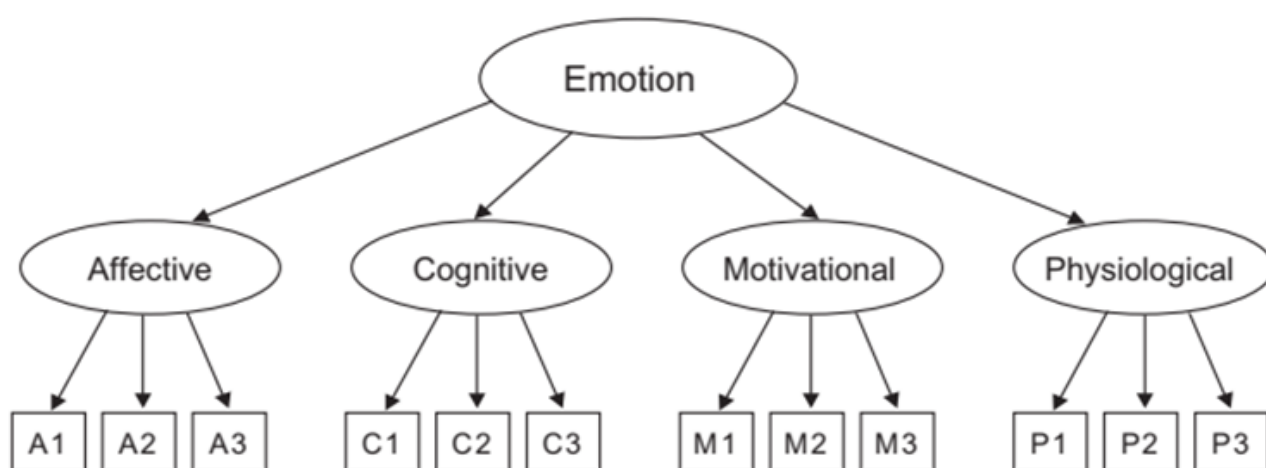


Figure 1. *First and second-order emotions hierarchy* (Note: Adapted from Pekrun et al., 2011, p. 37)

The Achievement Emotions Questionnaire-Short (AEQ-S) (Bieleke et al., 2021) is a shorter validated version of the original AEQ. Like the full version, it is a self-report instrument that assesses students' achievement emotions in three contexts: attending lectures, studying,

and sitting for examinations. In each situation, the items assess emotional experiences before, during, and after the reported achievement.

The AEQ-S identifies nine emotions: four positive (enjoyment, hope, pride, relief) and five negative (anger,

anxiety, shame, hopelessness, boredom). The AEQ-S categorises all emotions into a 2x2 matrix: (positive vs. negative) and (activating vs. deactivating). The upper two quadrants in Figure 2 below show positive activating

emotions and deactivating emotions: enjoyment, hope, pride, and relief. The lower two quadrants show negative activating and deactivating emotions: anger, anxiety, hopelessness, shame, and boredom.

Emotion classification considering valence and activation			
		Activation	
		Activating	Deactivating
Valence	Positive	Enjoyment	Relief & Relaxation
		Hope	
		Pride	
	Negative	Anger Anxiety Shame	Hopelessness Boredom

Figure 2. *Emotion classification: valence and activation* (Note: Adapted from Peixoto et al., 2015, p. 474)

2.1. Gender issues

It is pertinent to examine how men and women rate their emotional responses to the situations presented in the AEQ-S. Chaplin and Aldao (2013) identified significant but tiny differences between the genders; girls generally express more positive emotions and more internalising negative emotions like sadness and anxiety than boys. Boys express more externalising emotions, such as anger, than girls. Pekrun et al. (2011) noted that the effect sizes for differences between male and female student participants on the AEQ were relatively small and did not generalise across settings, except for anxiety. Ganotice et al. (2025) and Reilly and Sánchez-Rosas (2021) reported significant gender differences in AEQ performance, but these differences varied across studies. Di (2022) reported gender differences in the AEQ-S on levels of prospective outcome emotions (hope, hopelessness, anxiety) and activity emotions (enjoyment, anger, boredom), but not on retrospective outcome emotions (pride, shame, anger). This suggests that such gender differences may be dependent on the context in which they are assessed.

3. Objectives

The current study examined achievement emotions among Maltese university students. It posed the following questions:

- Is Bieleke et al.'s (2021) adapted version of the Achievement Emotions Questionnaire usable in a country with cultural and linguistic characteristics different from those in which it was validated?
- What are the differences in the mean scores of the Maltese cohort compared to Canadian means?
- Do males and females express their achievement emotions differently?

4. Method

This study employed a cross-sectional design and used an online English-language questionnaire to collect data. Malta's largely bilingual status means English is widely used, and the university's official language of communication is English. Additional demographic data were collected on respondents' gender and the level and

type of course they were following. The University of Malta Research Ethics Committee approved this study.

4.1. Instrument

The AEQ-S was validated on a sample of 471 undergraduate Canadian university students aged approximately 20 years. It is not a diagnostic tool and does not have officially prescribed norms. To our knowledge, only Rezaiee et al. (2025) have administered the questionnaire to a population like that on which it was validated: undergraduate university students. The AEQ-S takes approximately 20 minutes, and respondents rate their emotional responses on a 5-point Likert scale, ranging from “strongly disagree” (1) to “strongly agree” (5). This short version exhibits excellent item characteristics: satisfactory reliability, high correlations with the original AEQ scales, strong structural relationships, intercorrelations among the scales, and similar levels of relations with external measures of achievement emotions. The AEQ-S identifies the same emotions as the AEQ.

5. Participants

Participants were recruited anonymously and voluntarily via email through the University of Malta’s registrar’s office. This self-selection procedure may have introduced bias by attracting a sample of highly emotional students wanting to vent their emotions. The questionnaire could be completed in a short time, but respondents could stop and resume their responses at their convenience to avoid fatigue. Respondents were asked to recall the emotions

they experienced during their university studies, specifically during lectures, learning, and examinations. Data were collected in two sessions: one in April and May 2022, preceding the end of the second-semester examination period, and a second in November and December 2022, well into the first semester.

One hundred and fifty-six students enrolled in undergraduate courses at the University of Malta participated in this study. This was short of the 359 responses required for an undergraduate student population of 5399 (University of Malta Annual Report, 2024), with a 95% confidence level and a 5% margin of error. The majority (39.7%) of students were enrolled in arts, languages, or social sciences courses ($n=62$), 4.5% in education-related courses ($n=7$), 9% in economics, accountancy or management-related courses ($n=14$), 14.1% in medicine-related courses ($n=22$), 26.3% in other courses ($n=41$) and 6.4% did not register their area of study ($n=10$). By the nature of their courses, these respondents experienced diverse types and levels of pressures. The majority (73.1%) identified as female ($n=114$), 23.1% as male ($n=36$), and 3.8% ($n=6$) as non-binary. This resulted in a gender imbalance.

6. Results

Table 1 below presents the results of this questionnaire. Even when fewer than 5% of data cells were left empty, we used the regression-based imputation option in IBM SPSS Statistics (Version 31) to address missing data and retain as much of the data as possible. It presents the comparative means between the Maltese and Canadian samples.

Table 1: Mean scores of the Maltese and Canadian cohorts showing Cohen’s d and confidence intervals of the Maltese data

Scale	Class-related Mean (SD) and Sig.		Learning-related Mean (SD) and Sig.		Test-related Mean (SD) and Sig.	
	Malta ^[a]	Canada ^[b]	Malta ^[a]	Canada ^[b]	Malta ^[a]	Canada ^[b]
Enjoyment	3.28** (0.87) $d=0.25$ CI=3.14-3.42	3.07 (0.77)	3.71** (0.76) $d=0.27$ CI=3.59-3.83	3.51 (0.73)	1.97** (.96) $d=-0.53$ CI=1.82-2.12	2.48 (0.81)
Hope	3.22 ns (0.82) $d=-0.07$ CI=3.09-3.50	3.27 (0.79)	3.1 ns (1.00) $d=-0.12$ CI=2.94-3.26	3.22 (0.83)	2.45** (1.06) $d=-0.47$ CI=2.28-2.62	2.94 (0.89)

Table 1: Mean scores of the Maltese and Canadian cohorts showing Cohen's *d* and confidence intervals of the Maltese data

Scale	Class-related Mean (SD) and Sig.		Learning-related Mean (SD) and Sig.		Test-related Mean (SD) and Sig.	
	Malta ^(a)	Canada ^(b)	Malta ^(a)	Canada ^(b)	Malta ^(a)	Canada ^(b)
Pride	3.56 ^{ns} (.87) <i>d</i> =0.15 CI=3.42-3.70	3.43 (0.72)	3.53 ^{ns} (0.97) <i>d</i> =0.02 CI=3.38-3.68	3.51 (0.76)	2.70 ^{**} (.99) <i>d</i> =-0.30 CI=2.55-2.86	3.00 (0.81)
Anger	2.49 ^{**} (.99) <i>d</i> =0.65 CI=2.34-2.65	1.85 (0.77)	3.07 ^{**} (1.02) <i>d</i> =0.34 CI=2.91-3.23	2.72 (0.87)	2.39 ^{**} (1.01) <i>d</i> =0.29 CI=2.23-2.55	2.09 (0.78)
Relief	-	-	-	-	4.03 ^{**} (.98) <i>d</i> =0.303	3.73 (0.81)
Anxiety	2.89 ^{**} (1.03) <i>d</i> =0.50 CI=2.73-3.05	2.38 (0.88)	3.78 ^{**} (1.02) <i>d</i> =0.57 CI=3.62-3.94	3.23 (0.93)	3.98 ^{**} (.96) <i>d</i> =0.49 CI=3.88-4.18	3.51 (0.92)
Shame	3.06 ^{**} (1.20) <i>d</i> =0.32 CI=2.87-3.25	2.68 (1.08)	2.78 [*] (1.15) <i>d</i> =0.17 CI=2.6-2.96	2.58 (0.93)	2.57 ^{**} (1.17) <i>d</i> =0.32 CI=2.39-2.75	2.19 (0.89)
Hopelessness	2.47 ^{**} (1.10) <i>d</i> =0.43 CI=2.30-2.64	1.99 (0.93)	2.59 ^{ns} (1.22) <i>d</i> =0.11 CI=2.40-2.78	2.46 (1.00)	2.98 ^{**} (1.25) <i>d</i> =0.63 CI=2.78-3.18	2.19 (0.89)
Boredom	3.56 ^{**} (1.04) <i>d</i> =0.37 CI=3.40-3.72	3.17 (0.92)	2.84 ^{**} (1.05) <i>d</i> =-0.26 CI=2.68-3.01	3.12 (0.98)	-	-

^(a)Maltese study (N=156); ^(b)Canadian study ((Bieleke et al. 2021), N=471); * *p*=0.05 (2-tailed); ** *p*=.01 (2-tailed); *d*=Cohen's effect size; CI=confidence interval.

Table 2 shows that Cronbach's alpha results are similar across the present and reference studies, if marginally higher.

Table 2: Scale descriptive statistics: Cronbach's alpha

Scale	Class-related α		Learning-related α		Test-related α	
	This study	$\Delta\alpha$ from Bieleke et al. (2021)	This study	$\Delta\alpha$ from Bieleke et al. (2021)	This study	$\Delta\alpha$ from Bieleke et al. (2021)
Enjoyment	.83	0.04	.77	0.13	.87	0.21
Hope	.75	0.02	.90	0.14	.90	0.13
Pride	.76	0.06	.84	0.14	.85	0.11
Anger	.83	0.05	.83	0.16	.86	0.12
Relief	-	-	-	-	.90	0.20

Table 2: Scale descriptive statistics: Cronbach's alpha

Scale	Class-related α		Learning-related α		Test-related α	
Anxiety	.80	0.09	.82	0.13	.80	0.03
Shame	.92	0.09	.87	0.14	.92	0.09
Hopelessness	.89	0.08	.91	0.12	.92	0.07
Boredom	.91	0.03	.88	0.03	-	-

Table 3 compares the Maltese data with Rezaiee et al.'s (2025) data from their sample of Iranian Persian speakers.

Table 3: Mean scores of the Maltese and Iranian cohorts showing Cohen's d and confidence intervals of the Maltese data.

Scale	Class-related Mean (SD) and Sig.		Learning-related Mean (SD) and Sig.		Test-related Mean (SD) and Sig.	
	Malta ^(a)	Iranian ^(b) Persian Speakers	Malta ^(a)	Iranian ^(b) Persian Speakers	Malta ^(a)	Iranian ^(b) Persian Speakers
Enjoyment	13.14** (3.47) $d=-.43$ CI=12.6-13.7	14.63 (3.80)	14.86** (3.03) $d=-.34$ CI=14-15.2	15.88 (3.3)	7.90** (3.84) $d=-1.11$ CI=7.30-8.50	12.14 (4.5)
Hope	12.86** (3.28) $d=-.68$ CI=12.35-13.38	15.09 (3.57)	12.40** (4.03) $d=-.86$ CI=11.77-13.03	15.88 (3.57)	9.79** (4.23) $d=-.91$ CI=9.13-10.45	13.62 (4.08)
Pride	14.24** (3.49) $d=-.40$ CI=13.69-14.79	15.63 (3.23)	14.12** (3.88) $d=-.55$ CI=13.51-14.73	16.27 (3.30)	10.80** (3.96) $d=-.78$ CI=10.18-11.42	13.87 (3.96)
Anger	9.98* (3.95) $d=.16$ CI=9.36-10.60	9.35 (4.01)	12.27** (4.07) $d=.99$ CI=11.63-12.91	8.22 (4.04)	9.55** (4.06) $d=.24$ CI=8.91-10.19	8.57 (3.99)
Relief	-	-	-	-	16.11 <i>ns</i> (3.92) $d=.13$ CI=15.5-16.73	15.61 (3.64)
Anxiety	11.58** (4.14) $d=.98$ CI=10.93-12.23	7.53 (3.80)	15.11** (3.83) $d=.16$ CI=14.51-15.71	8.63 (3.96)	15.93** (3.85) $d=1.59$ CI=15.31-16.54	9.83 (4.14)

Table 3: Mean scores of the Maltese and Iranian cohorts showing Cohen's d and confidence intervals of the Maltese data.

Scale	Class-related Mean (SD) and Sig.		Learning-related Mean (SD) and Sig.		Test-related Mean (SD) and Sig.	
Shame	12.24** (4.79) $d=.95$ CI=11.49-12.99	7.69 (4.43)	11.11** (4.58) $d=.75$ CI=10.39-11.83	7.68 (4.13)	10.28** (4.70) $d=.58$ CI=9.54-11.02	7.55 (4.19)
Hopelessness	9.87** (4.41) $d=.71$ CI=9.18-10.56	6.73 (3.79)	10.38** (4.87) $d=.70$ CI=9.62-11.14	6.98 (3.91)	11.92** (5.00) $d=.95$ CI=11.14-12.71	7.16 (4.20)
Boredom	14.22** (4.15) $d=1.35$ CI=13.57-14.87	8.61 (4.45)	11.38** (4.20) $d=.73$ CI=10.72-12.04	8.30 (4.47)	-	-

^(a)Maltese study (N=156); ^(b)Iranian study ((Rezaiee et al., 2025), N=1153); * $p=.05$ (2-tailed); ** $p=.01$ (2-tailed); d =Cohen's effect size; CI=Confidence interval.

The internal reliability of the three subscales was acceptable: class-related emotions - Cronbach's $\alpha = .70$; learning-related emotions - Cronbach's $\alpha = .75$; test-related emotions - Cronbach's $\alpha = .62$. The KMO (Kaiser-Meyer-Olkin) measures of sampling adequacy for the three principal component analyses were .84, .87, and .81 and were deemed to be meritorious (Kaiser & Rice, 1974). A highly significant Bartlett's Test of Sphericity indicated that the correlation matrix exhibited significant correlations among at least some variables and was adequate for factor analysis (Bartlett, 1951).

A Principal Components Analysis (PCA), based on extracting components with eigenvalues greater than one and using Varimax rotation, was conducted for emotions across the three settings to ensure a basic level of conformity with the theoretical structure. Two principal components were extracted for class - and learning-related emotions, explaining 69.2% and 70.8% of the variance in the scores, respectively. Three principal components for test-related emotions were extracted; however, a two-component extraction was forced to determine whether the same pattern of extraction held. The extracted components explained 66.2% of the variance in the scores. The rotated plots are shown in Figures 3 to 5, clearly extracting positive and negative activating/deactivating valence components.

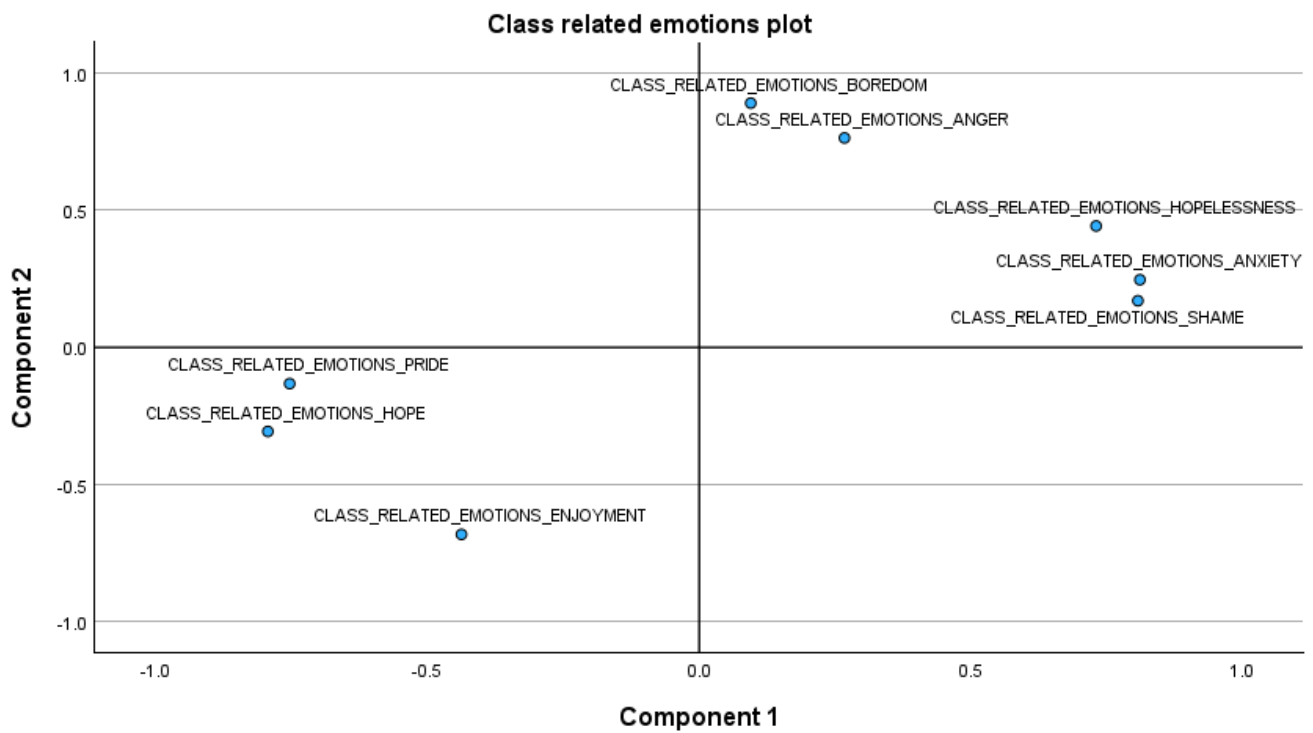


Figure 3. Classroom-based emotions

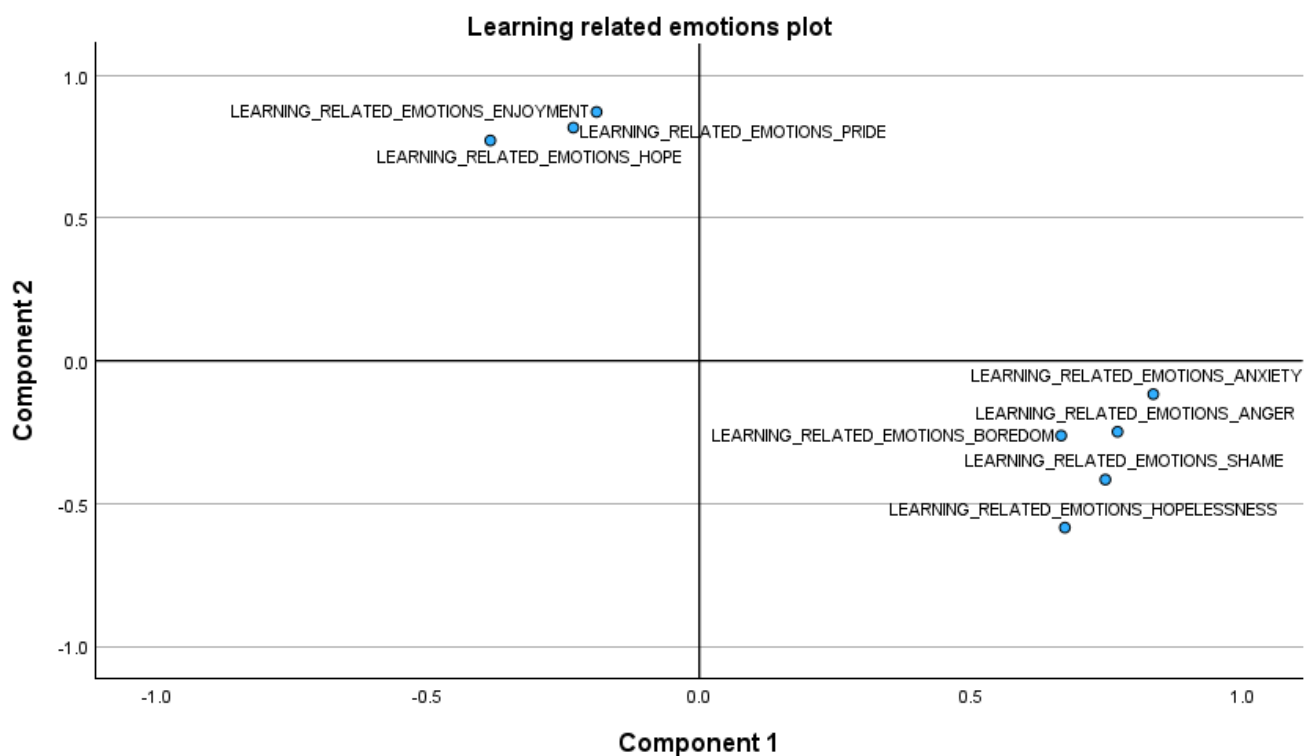


Figure 4. Learning-based emotions

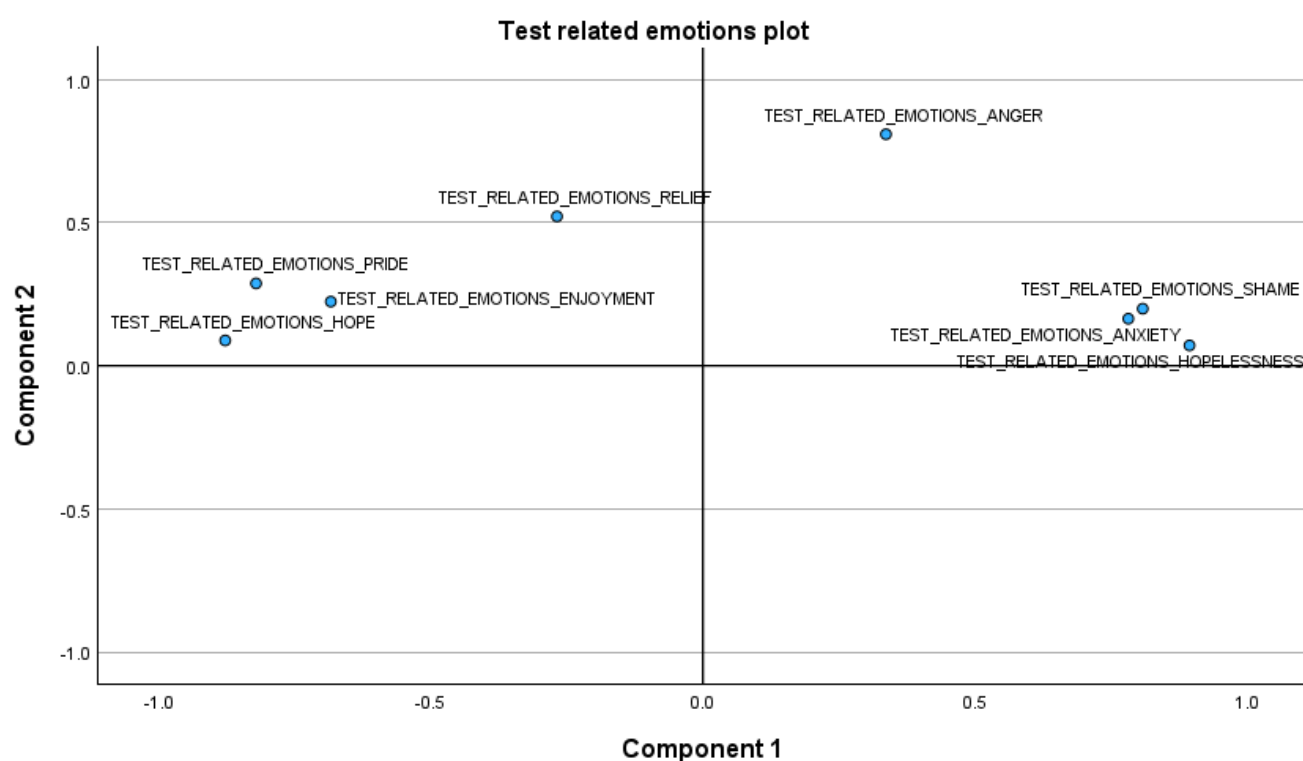


Figure 5. Test-based emotions

6.1. Gender differences

The second objective was to examine differences in achievement emotions by gender. A one-sided *t*-test identified a significant difference only for class – and test-related anger. In a class context, males ($M=2.75$, $SD=.99$) reported significantly higher levels of anger than females ($M=2.41$, $SD=.99$), $t(148)=1.79$, $p=.038$. In a test context,

males ($M=2.64$, $SD=1.05$) reported significantly higher levels of anger than females ($M=2.29$, $SD=.99$), $t(148)=1.82$, $p=.035$. In a learning context, females ($M=3.07$, $SD=1.04$) reported non-significantly higher levels of anger than males ($M=3.02$, $SD=.98$), $t(148)=-.24$, $p=.41$. Table 4 below shows the mean scores for all emotions in the three contexts by gender.

Table 5: Scale means and SD by gender

Scale	Class-related Mean (SD)		Learning-related Mean (SD)		Test-related Mean (SD)	
	Males N=36	Females N=114	Males N=36	Females N=114	Males N=36	Females N=114
Enjoyment	3.31 (.93)	3.25 (.86)	3.60 (.86)	3.76 (.71)	1.93 (1.02)	1.99 (.96)
Hope	3.15 (.87)	3.23 (.82)	3.07 (1.09)	3.09 (.98)	2.44 (1.13)	2.45 (1.01)
Pride	3.42 (1.02)	3.61 (.82)	3.41 (1.20)	3.55 (.89)	2.72 (1.15)	2.69 (.93)
Anger	2.75* (.99)	2.41 (.10)	3.02 (.98)	3.07 (1.04)	2.64* (1.05)	2.29 (.99)

Relief	-	-	-	-	4.10 (1.13)	3.99 (.95)
Anxiety	2.84 (.99)	2.92 (1.06)	3.59 (1.03)	3.83 (.93)	3.91 (1.00)	4.02 (.97)
Shame	3.08 (1.24)	3.05 (1.21)	2.86 (1.11)	2.77 (1.17)	2.56 (1.05)	2.57 (1.23)
Hopelessness	2.46 (1.13)	2.46 (1.11)	2.67 (1.11)	2.57 (1.26)	2.83 (1.31)	3.03 (1.23)
Boredom	3.60 (.92)	3.60 (1.08)	3.01 (.97)	2.80 (1.08)	-	-

* $p=0.05$ (1-tailed)

7. Discussion

The AEQ-S samples the second-order emotions to differing degrees. It predominantly samples emotions that can best be described as affective and motivational, thereby addressing two of the domains in Figure 1 above. Whilst there are clear and uniform similarities between the results of the Maltese and the Canadian and Iranian cohorts, distinct trends emerged in the Maltese cohort. Compared with the Canadian cohort, Maltese students reported significantly higher levels of positive emotions (Enjoyment in Class and in Learning-related contexts) but also statistically significantly lower scores in Enjoyment, Hope, and Pride in Test-related contexts. They also expressed statistically significantly more negative deactivating emotions, such as Anger, Anxiety, and Shame, across all contexts. Likewise, they expressed more Hopelessness (a negative deactivating emotion) across the three contexts, but only significantly so in the Class and Test-related contexts. They were statistically significantly more bored (a negative deactivating emotion) in a Class-related context but statistically significantly less bored in a Learning-related context. Finally, they reported statistically higher levels of Relief (a positive deactivating emotion) in a test situation than their Canadian counterparts.

As a group, the respondents appeared more threatened by the educational process than the Canadian group, despite apparently expressing greater Enjoyment in Class and in Learning-related contexts. Their negative emotional levels were generally higher than those of the Canadian reference group (except for Learning-related boredom). This is particularly evident in the Test-related context, where they consistently express lower positive and higher negative emotions.

The situation is similar, if even more pronounced, in relation to the Iranian Persian-speaking cohort. The Maltese respondents reported significantly lower levels of positive activating emotions (Enjoyment, Hope, Pride), comparable levels of positive deactivating emotions (Relief), and statistically significantly higher levels of negative activating emotions (Anger, Anxiety, Shame) and deactivating emotions (Hopelessness, Boredom) across all relevant contexts.

The literature on gender differences in emotions (Chaplin & Aldao, 2013) suggests that some differences would be evident in this sample. However, gender differences on the AEQ were reportedly small (Pekrun et al., 2011). Surprisingly, there were no significant differences in any of the emotions assessed, except anger, and males registered significantly higher levels only in Class and Test-related contexts. This lack of gender differences may be attributed in part to the nature of the AEQ and in part to the limited sample size, which precluded the identification of minor gender differences.

What is the emergent picture for the respondents in this study compared to the reference (Canadian) and the Iranian group? One must caution against overinterpreting the results for the reasons outlined above (self-selection, small cohort, gender imbalance). The implications for the affective and motivational aspects of achievement emotions (Figure 1) are several and stem from students' high value but low control over the academic process across the three situations.

Maltese undergraduate students seemed more anxious and less optimistic than their Canadian and Iranian peers. They demonstrated a consistent pattern of a hostile affective climate, as evidenced by higher anger, anxiety, shame, hopelessness, and, to some extent,

boredom. This suggests emotional strain across the three learning contexts. Specifically, the respondents showed low perceived control over their academic outcomes as indicated by their high levels of anxiety, shame, and hopelessness. Respondents' mean reported scores for emotions like anxiety or shame suggest that they cared about the task, but the emotional cost was high. Their higher levels of anger and boredom suggest maladaptive motivation, potentially leading to superficial learning rather than mastery, with a risk of academic burnout and low achievement. One asks whether, these respondents perceive their experience of a tertiary education as autocratic and authoritarian? One queries what experiences they have had in their educational histories. On the other hand, does the fact that all undergraduate courses are free of charge affect their achievement expectations and emotions?

One cautions against overinterpretation, but addressing such a student profile would require a comprehensive strategy rooted in Control-Value Theory that focuses on rebuilding students' sense of control, enhancing the value of learning, and strengthening emotional regulation. One must consider increasing respondents' perceived control to address this issue, as many negative emotions arise when students feel uncertain or powerless. This could involve improved assessment transparency, frequent low-stakes practice, and explicit teaching of learning and test-taking strategies to enhance feelings of competence. One could also counteract anger and boredom with meaningful, real-world examples and tasks, offering autonomy through the choice of topics or formats. Alongside these academic and emotional supports, students benefit from direct training in emotion regulation, including attentional shifting, cognitive reframing, and reflective practices that help them understand and manage their emotions. Finally, because negative achievement emotions can reflect underlying skill gaps, one should consider additional academic and counselling support when necessary. To explicitly address the respondents' significantly lower positive and higher negative assessment-related emotions, one could consider administering examinations in an open-book format, allowing students to sit for exams when ready, and including oral components to ensure that exams are not entirely paper-based. These are a few stress-reducing practices that may mitigate disenchantment with the higher education process.

8. Limitations

This study has several limitations. The number of participants is approximately 3% of the undergraduate population, invited via email and granted access to the online questionnaire. This small sample size is suboptimal, and the sampling was non-probability; there may be a self-report bias. Furthermore, there is a gender imbalance. There may also be other factors the author is unaware of, such as respondents' levels of achievement, which may indicate they were struggling to meet expectations or finding academic life difficult for a range of other reasons. No screening was conducted for any neuroatypical or physical conditions that may have affected participants' responses. Respondents were presented with an English-language questionnaire; one wonders whether a Maltese version would have yielded different results. Finally, this study calls for larger-scale replications using the AEQ-S to co-validate with clinical tools and to develop norms, so that students' lives in university settings may be better understood and supported along with some qualitative analysis of their expressed emotions.

9. Conclusions

The results of two quoted studies (Bieleke et al., 2021; Rezaiee et al., 2025) and the present study are comparable despite differences in culture; effectively, Maltese undergraduates are still living at home with their parents and wider family networks, while Canadian students are living away from home and away from parental emotional support. A comparison with the two quoted studies reveals a clear, concerning trend. Although the means of the Maltese participants differed from the comparison studies, these differences were not random and indicated a trend. Whether these differences were actual, cultural, situational, or temporal remains a moot point until further research is undertaken. One asks whether these findings are influenced by stress related to bilingual instruction, issues related to a small-island mindset, particularly within the broader context of EU membership, and university assessment practices. Regarding gender, as in other studies, males were more likely than females to express anger, but only in two contexts. Future research directions include qualitative analysis of results, longitudinal studies, and cross-cultural comparisons. This may have implications for Maltese higher-education assessment practices and student support, as discussed earlier. Finally, replication

of this study in controlled settings and validation against other measures may lead to standardisation and the development of a group screener that can be used to support individuals or groups of students in university settings.

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Conflict of interest

The author reports no conflict of interest.

References

- Bartlett, M. S. (1951). The effect of standardization on a Chi-square approximation in factor analysis. *Biometrika*, 38(3/4), 337–344.
- Bieleke, M., Gogol, K., Goetz, T., Daniels, L., & Pekrun, R. (2021). The AEQ-S: A short version of the Achievement Emotions Questionnaire. *Contemporary Educational Psychology*, 65. <https://doi.org/10.1016/j.cedpsych.2020.101940>.
- Chaplin, T.M. & Aldao, A. (2013). Gender Differences in Emotion Expression in Children: A Meta-Analytic Review. *Psychological Bulletin*, 139(4), 735–765. <https://doi.org/10.1037/a0030737>
- Di, S. (2022). Does Gender Matter in Achievement Emotions? *Open Access Journal of Addiction and Psychology*, 6(1). <https://doi.org/10.33552/OAJAP.2022.06.000628>.
- Ganotice, F. A., Shen, X., Dizon, J. I. W. T. et al. (2025). Achievement emotions in healthcare education: understanding the application of achievement emotions questionnaire. *BMC Medical Education*, 25:953. <https://doi.org/10.1186/S12909-025-07526-8>
- Joëls, M., Pu, Z., Wiegert, O., Oitzl, M. S., & Krugers, H. J. (2006). Learning under stress: How does it work? *Trends in Cognitive Sciences*, 10(4), 152–158. <https://doi.org/10.1016/j.tics.2006.02.002>
- Kaiser, H. F., & Rice, J. (1974). Little Jiffy, Mark Iv. *Educational and Psychological Measurement*, 34(1), 111–117. <https://doi.org/10.1177/001316447403400115>
- Lipson, S. K., Zhou, S., Abelson, S., Heinze, J., Jirsa, M., Morigney, J., ... & Eisenberg, D. (2022). Trends in college student mental health and help-seeking by race/ethnicity: Findings from the National Healthy Minds study, 2013–21. *Journal of Affective Disorders*, 306, 138–147.
- Peixoto, F., Mata, L., Monteiro, V., Sanches, C. & Pekrun, R. (2015). The Achievement Emotions Questionnaire: Validation for Pre-Adolescent Students. *European Journal of Developmental Psychology*, 12(4), 472–481. [doi: 10.1080/17405629.2015.1040757](https://doi.org/10.1080/17405629.2015.1040757)
- Pekrun, R. (2006). The control-value theory of achievement emotions: Assumptions, corollaries, and implications for educational research and practice. *Educational Psychology Review*, 18, 315–341.
- Pekrun, R., Goetz, R., & Perry, R. P. (2005). Achievement Emotions Questionnaire (AEQ) – User's Manual. <https://www.researchgate.net/profile/Javier-Sanchez-Rosas/post/How-can-i-apply-and-access-the-Academic-Emotions-Questionnaire-by-Pekrun-et-al-2005/attachment/59d6351c79197b8077992b77/AS%3A383031052390406%401468333127197/download/2005+AEQ+Manual.pdf>
- Pekrun, R., Goetz, T., Frenzel, A. C., Barchfeld, P., & Perry, R. P. (2011). Measuring emotions in students' learning and performance: The Achievement Emotions Questionnaire (AEQ). *Contemporary Educational Psychology*, 36(1), 36–48.
- Pekrun, R., Goetz, T., Titz, W., & Perry, R. P. (2002). Academic emotions in students' self-regulated learning and achievement: A program of quantitative and qualitative research. *Educational Psychologist*, 37, 91–106.
- Putwain, D. W., Wood, P., & Pekrun, R. (2022). Achievement emotions and academic achievement: Reciprocal relations and the moderating influence of academic buoyancy. *Journal of Educational Psychology*, 114(1), 108–126. <https://doi.org/10.1037/edu0000637>
- Reilly, P., & Sánchez-Rosas, J. S. (2021). Achievement emotions and gender differences associated with second language testing. *International Journal of Instruction*, 14(4), 825–840.

- Rezaiee, M., Kareshki, H., & Yazdi, S. A. A. (2025). A Short Form of the Achievement Emotions Questionnaire: Measurement Model and Its Association with Career Adaptability, Epistemic Emotion, Academic Buoyancy, and Academic Satisfaction. *Psihologija*, 58(4), 463–479. <https://doi.org/10.2298/PSI230511011R>
- Riegel, K., & Evans, T. (2021). Student achievement emotions: Examining the role of frequent online assessment. *Australasian Journal of Educational Technology*, 37(6), 75–87.
- Tyng CM, Amin HU, Saad MNM, & Malik AS. (2017). The Influences of Emotion on Learning and Memory. *Frontiers in Psychology*. 8:1454. doi: 10.3389/fpsyg.2017.01454
- University of Malta. (2024). *Annual Report 2004*. Msida, Malta: University of Malta. <https://www.um.edu.mt/media/um/docs/about/factsandfigures/annualreport2024.pdf>
- Vella, S., & Cassar, J. (2022). Young People and Family Formation in Malta. In M. Emirhafizovic, T. Heiman, M. Medgyesi, C. P. Mota, S. Tomanovic, & S. Vella (Eds), *Family Formation Among Youth in Europe: Coping with Socio-Economic Disadvantages* (pp. 139-157). Emerald Publishing Limited. <https://doi.org/10.1108/978-1-64802-905-920251010>
- Vogel, S., & Schwabe, L. (2016). Learning and memory under stress: implications for the classroom. *npj Science of Learning* 1, 16011. doi:10.1038/npjscilearn.2016.11
- Weiner, B. (1985). An attributional theory of achievement motivation and emotion. *Psychological Review*, 92, 548–573.

Research Article

Stress and Lifestyle Behaviour Changes in Maltese University Students During Examinations: A Cross-Sectional Study

Gabriella D'Aponte

Department of Food Science, Nutrition and Dietetics, Faculty of Health Sciences, University of Malta, Msida

Claire Copperstone

Department of Food Science, Nutrition and Dietetics, Faculty of Health Sciences, University of Malta, Msida

Abstract

Examination periods are known to be stressful for university students, often leading to unhealthy lifestyle behaviour changes. This study aimed to assess the levels of self-perceived stress and evaluate the potential link between any self-reported dietary and lifestyle changes and stress during one examination period for University of Malta (UM) students. A cross-sectional study was conducted using a quantitative, anonymised survey design targeting students aged 18 years and above. Data were collected on dietary and lifestyle habits and changes, and perceived stress levels were measured using the Perceived Stress Scale, PSS4, during the January 2024 exam period. Ethical approval was obtained from the Faculty Research Ethics Committee (FREC) at the University of Malta. Data were analysed using SPSS (IBM®version 29), with Chi-square tests applied to assess potential associations between categorical variables. 196 respondents returned the survey. Most were female (79.1%) and aged 18-25 years (80.6%). The majority reported increased consumption of sugary (73%) and salty snacks (54.6%), while 40.3% reported higher sugary drink consumption. Additionally, 50% of students reported meal skipping, and 51.5% indicated decreased

physical activity. Adverse sleep patterns were reported by most (81.1%) of participants. During examinations nearly half of the participants sometimes felt unable to control key aspects of their lives, and another 29.1% felt this often. The findings highlight some negative changes in dietary habits and lifestyle behaviours during the examination period. These results underscore the importance of promoting healthy lifestyle strategies to support students during challenging times.

Keywords: students, dietary behaviours, examination periods, sleep behaviours, mental well-being.

1. Introduction

Stress and dietary habits are intricately linked, with this topic gaining significant attention from health sciences and related research in recent years. The modern-day pressures faced by young adults are particularly prominent (Mikolajczyk et al., 2009; Walker-Harding et al., 2017). Young adulthood, generally considered between the ages of 18 and 25, is a critical period for establishing long-term dietary habits and lifestyle behaviours. Maintaining a balanced and nutritious diet during stressful times, such as examination periods for university students who normally fit within this age period, is essential for their mental health and overall wellbeing, academic performance, and physical wellbeing (Firth et al., 2020). Increased stress levels during examinations can lead to a number of hormonal and behavioural changes, which in turn can affect dietary patterns and overall well-being (Choi, 2020; Michels et al., 2020).

Correspondence to Gabriella D'Aponte

gabriella.daponte.17@um.edu.mt

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Emotional eating, a common response to stress, involves the consumption of food as a coping mechanism for negative emotions (Macht, 2008). Elevated stress levels are associated with increased cortisol production, which, beyond its role in the fight-or-flight response, can stimulate hunger and cravings for calorie-dense, sweet, salty, and fatty foods (Chao et al., 2017; Torres & Nowson, 2007). Prolonged exposure to elevated cortisol may contribute to poor dietary choices (Macht, 2008). However, in some people stress may also suppress appetite, a response linked to the release of noradrenaline and corticotropin-releasing hormone (Torres & Nowson, 2007). Consuming a healthy diet may alleviate stress and improve mood, while diets high in sugar and salt have been associated with increased mental and physical stress (Jacques et al., 2019; Smiley, 2022).

Additionally, nutritional deficiencies may further contribute to low mood (Firth et al., 2020). While mood influences food choices, a diet high in processed carbohydrates—such as packaged snacks, confectionery items such as chocolates, and foods high in fat and salt such as ready-made meals—can heighten stress and trigger overeating due to rapid fluctuations in blood glucose levels (Firth et al., 2020). There is also evidence that perceived stress can lead to poorer dietary choices, creating a cyclical pattern (Errisuriz et al., 2016). Research indicates that individuals under stress often seek comfort in foods they usually avoid, turning to processed foods to improve their emotional state (Mikolajczyk et al., 2009).

Although numerous international studies have addressed the effects of stress on dietary behaviours, there is a notable gap in research concerning university students in Malta and eating habits during stressful periods such as examination periods. Understanding how a stressful period could influence eating habits, physical activity, and sleep, could provide insights into effective interventions for improving student well-being. The primary aim of this study was therefore to look at lifestyle-related behaviours and any potential changes during one examination period. Specifically, the study sought to:

1. Assess any changes in lifestyle behaviours, such as sleep and physical activity, in University of Malta students during a stressful examination period.
2. Evaluate any changes in dietary patterns, including meal skipping and portion size changes during one examination period, and explore their relationship with demographic factors such as gender and income.

3. Identify levels of self-perceived general stress during one examination period.

2. Methods

Convenience sampling was employed. Participants were invited to complete an anonymised online survey disseminated via email by the University of Malta (UM) Registrar's Office and through the personal Facebook page of the primary researcher, after ethics approval from the Faculty Research Ethics Committee (FREC). A participant information letter outlining the study aims, and main ethical considerations, was provided with the survey. Participation was voluntary, and participants had the option of not completing and submitting the survey. Submitting the survey implied consent.

Inclusion criteria: Students aged 18 years and above and attending the University of Malta.

Exclusion criteria: Anyone not attending the University of Malta or under 18 years of age.

2.1. Sample size calculation

The calculation was based on a 95% confidence level, a student population size of 10,000 students, and a margin of error of 7%. Using these parameters, a minimum sample size of 193 respondents was required to ensure statistically significant results.

2.2. Data collection instruments

A cross-sectional study design was utilised. The survey, administered using Google Forms, was open for responses from mid-January to early February 2024, which coincided with the January 2024 examination period. A pilot study was carried out to ensure the survey's clarity and usability for the target population. Based on feedback from the students who took part in the pilot study, minor changes were made to improve understanding and ease of completion. This included: revision of some food group descriptions and rewording of some of the diet-related questions to enhance readability, some changes were also made to the PSS-4 scale such as rewording the question for one item and also changing the reference timeline (one month to two weeks) to improve comprehensibility and reflect this study better.

The final questionnaire included five sections with a total of 20 questions.

The first section covered demographics: Nine questions assessed the demographic characteristics of the sample. These provided key information about age, gender, nationality, year of study, level and faculty attending, household structure and annual income.

The second section focused on dietary habits, where a Food Frequency Questionnaire (FFQ), adapted from Michels et al. (2020) following authors' consent, assessed students' self-reported consumption for various food groups. Participants were asked to indicate their weekly frequency of consumption for various food groups, with options ranging from no consumption to daily consumption. Participants then indicated whether their consumption of these food groups had increased, decreased, or remained unchanged during the examination period as compared to habitual (non-examination period) consumption. The FFQ was semi-quantitative in design, capturing the frequency of consumption, but not portion sizes.

The third section utilised the 4-item Perceived Stress Scale (PSS-4), originally developed by Cohen, Kamarck, and Mermelstein (1983). The scale includes four items rated on a 5-point Likert scale ranging from 0 (Never) to 4 (Very Often), measuring the frequency of stress-related thoughts and feelings over the past month. The PSS-4 item scales are usually added to obtain a total score, with higher scores representing higher perceived stress. For the purposes of this local study, the PSS-4 scale was utilised to present proportions of participants responding to each Likert scale level for each of the four items. The PSS-4 was selected for its brevity, demonstrated consistency and reliability, and comparable validity to PSS-10 and PSS-14, thus reducing participant burden. It is still being utilised in research and is considered to be useful when collecting data over the Internet because of the shorter time to fill in. Despite being developed in 1983, the PSS-4 remains widely relevant and used across populations, including European populations (Vallejo et al., 2018). Participants were also asked about the frequency of stress affecting their eating habits during the examination period, on a five-point scale ranging from 'never' to 'very often'.

The fourth and final section measured physical activity and sleep parameters: reported changes in students' physical activity and sleep patterns during the examination period. Questions included: typical daily sleep schedules, where participants reported the usual average number of hours they slept per day; sleep changes during examination periods, where participants

indicated whether their sleep pattern changed during the examination period (Yes or No); physical activity changes during examinations where participants were asked to specify if their physical activity levels increased, decreased, or remained the same during the examination period.

2.3. Statistical analysis

Survey responses were exported from Google Forms into Microsoft Excel (v.16.90) and subsequently imported into SPSS (v29, IBM©) for statistical analysis.

- **Descriptive statistics:** Percentages for categorical variables including age group, gender, income, and year of study were calculated and presented in tables.
- **Data analysis:** The Chi-square test of independence was conducted to examine associations between two categorical variables across various parameters of dietary behaviours and demographics. This included associations between age groups and sugary drink consumption, meal skipping and yearly income levels, gender and changes in food portion sizes, gender and changes in take-away food consumption. The association between sleep changes and gender was also examined.

The null hypothesis (H_0) stated that there was no association between the variables, which would be accepted if the p-value was greater than 0.05, while the alternative hypothesis (H_1) indicated a significant association if the p-value was less than 0.05.

2.4. Ethical Considerations

Participation was voluntary and anonymised, and all participants provided informed consent prior to data collection. While no direct incentives were provided, participants may have benefited from reflecting on their stress levels and eating habits during a period of academic demands. The study's main objectives focused on detecting potential dietary changes and were not intended to diagnose or assess any mental health problems, minimising potential psychological discomfort. Participants were also informed of their right to withdraw at any time during the filling in of the survey without any consequences. All ethical requirements were successfully addressed prior to the dissemination of the survey, and ethical approval was obtained from the Faculty Research Ethics Committee

(FREC) at the University of Malta (Approval ID: FHS-2023-00394, 12 January 2024).

3. Results

3.1. Sample characteristics

The survey yielded 196 responses. The sample was predominantly female, accounting for 79.1% (n=155), and aged between 18 and 25 years (80.6%, n=158). Nearly a third

of respondents were in their first year of studies (31.6%, n=62). Over two-thirds were following an undergraduate course (68.9%, n=135). 89.3% (n=175) of respondents indicated that they lived with their family, friends, or partners. For obesity status, measured as the Body Mass Index (BMI), 18.2% (n=35) of participants self-reported a BMI of over 30 kg/m², while slightly more than half (54.2%, n=104) were classified within the healthy BMI range (18.5-24.9 kg/m²). These results are shown in Table 1.

Table 1: Demographic characteristics of the sample

Characteristics	Number of participants (%)
Gender	
Male	41 (20.9%)
Female	155 (79.1%)
Citizenship	
Maltese	172 (87.8%)
Other EU	15 (7.7%)
Non-EU	9 (4.6%)
Age group	
18-25	158 (80.6%)
26-30	12 (6.1%)
31-40	7 (4.6%)
41-50	11 (5.6%)
51-60	4 (2%)
61 and above	2 (1%)
Study Mode	
Full time	168 (85.7%)
Part time	28 (14.3%)
Study Level	
Certificate or Diploma	11 (5.6%)
Undergraduate	135 (68.9%)
Postgraduate	50 (25.5%)
Year of Study	
1st Year	62 (31.6%)
2nd Year	40 (20.4%)
3rd Year	53 (27.0%)
4th Year	19 (9.7%)
5th Year	12 (6.1%)
Other	10 (5.2%)
Household Structure	
Living alone	21 (10.7%)
Living with family or friends	175 (89.3%)

Table 1: Demographic characteristics of the sample

Characteristics	Number of participants (%)
Income (yearly)	
0-10000 euros	146 (74.5%)
10,001-20,000 euros	21 (10.7%)
20,001-30,000 euros	14 (7.1%)
30,001+ euros	15 (7.7%)
BMI (kg/m²) *n=192	
Underweight <18.5	9 (4.7%)
Normal weight (18.5-24.9)	104 (54.2%)
Overweight (25.0- 29.9)	44 (22.9%)
Obese >30	35 (18.2%)

3.2. Pre-examination period consumption patterns

In Table 2, students' self-reported consumption patterns for non-examination periods are shown across various food groups measured retrospectively. Dairy products were frequently consumed, with 52% (n=102) indicating daily intake. Lean proteins, such as poultry, were also popular, with 52% (n=102) consuming between twice to four times weekly. Staple carbohydrates, particularly bread, were a significant part of the diet, and were mostly consumed five to six times per week by 26% (n=51) of participants. Additionally, rice and pasta were consumed by 38.8% (n=76) of participants at a frequency of two to four times per week.

For red meat, 31.6% (n=62) of participants reported consumption once a week, while 33.7% (n=66), consumed

it two to four times a week. Sugary snacks consumption varied in frequency, with 28.1% (n=55) consuming them daily and 23% (n=45) eating them two to four times a week. Crisps and other salty snacks followed a similar trend, with 27% (n=53) eating them once a week and 25% (n=49) consuming them two to four times a week. Processed meats were consumed by 26.5% (n=52) two to four times a week.

For fruit and vegetable consumption, 25.5% (n=50) reported consuming fruits daily and 32.1% (n=63) eating vegetables daily. Energy drinks and alcohol consumption: 65.8% (n=129) reported never or rarely drinking energy drinks, while 45.4% (n=89) consumed alcohol less than once a month. Fish and seafood were the least consumed, with 3.1% (n=6) eating them five to six times a week.

Table 2: Pre-examination period food group consumption patterns

Food Group	Never or less than once a month (N, %)	1 to 3 times a month (N, %)	Once a week (N, %)	2 to 4 times a week (N, %)	5 to 6 times a week (N, %)	Every day (N, %)
Dairy products	6 (3.1%)	8 (4.1%)	19 (9.7%)	33 (16.8%)	28 (14.3%)	102 (52.0%)
Red meat	23 (11.7%)	40 (20.4%)	62 (31.6%)	66 (33.7%)	5 (2.6%)	0 (0.0%)
Processed meats	36 (18.4%)	35 (17.9%)	47 (24.0%)	52 (26.5%)	17 (8.7%)	9 (4.6%)
Poultry	11 (5.6%)	14 (7.1%)	41 (20.9%)	102 (52.0%)	22 (11.2%)	6 (3.1%)

Table 2: Pre-examination period food group consumption patterns

Food Group	Never or less than once a month (N, %)	1 to 3 times a month (N, %)	Once a week (N, %)	2 to 4 times a week (N, %)	5 to 6 times a week (N, %)	Every day (N, %)
Fish and other seafood	51 (26.0%)	61 (31.1%)	58 (29.6%)	20 (10.2%)	6 (3.1%)	0 (0.0%)
Sugary drinks	46 (23.5%)	38 (19.4%)	34 (17.3%)	31 (15.8%)	17 (8.7%)	30 (15.3%)
Energy drinks	129 (65.8%)	23 (11.7%)	12 (6.1%)	14 (7.1%)	7 (3.6%)	11 (5.6%)
Alcohol drinks	89 (45.4%)	65 (33.2%)	31 (15.8%)	10 (5.1%)	0 (0.0%)	0 (0.0%)
Sugary snacks	9 (4.6%)	13 (6.6%)	35 (17.9%)	45 (23.0%)	39 (19.9%)	55 (28.1%)
Crisps and salty snacks	20 (10.2%)	31 (15.8%)	53 (27.0%)	49 (25.0%)	25 (12.8%)	18 (9.2%)
Fruits	9 (4.6%)	21 (10.7%)	35 (17.9%)	54 (27.6%)	27 (13.8%)	50 (25.5%)
Vegetables	6 (3.1%)	7 (3.6%)	35 (17.9%)	49 (25.0%)	36 (18.4%)	63 (32.1%)
Bread	2 (1.0%)	20 (10.2%)	24 (12.2%)	50 (25.5%)	51 (26.0%)	49 (25.0%)
Pasta and rice	3 (1.5%)	12 (6.1%)	32 (16.3%)	76 (38.8%)	55 (28.1%)	18 (9.2%)

$\chi^2(32) = 608.74, p = < 0.001$

3.3. Examination period food consumption changes

Self-reported changes in consumption during the examination period are shown in Table 3. 70.9% (n=139), reported *no change* for dairy products, for red meats, (78.1%, n=153), and poultry (75%, n=147). Additionally, 78.6% (n=154) reported *no change* in fish and seafood consumption, 69.4% (n=136) for processed meats, 61.2% (n=120) for bread, 66.8% (n=131) for pasta and rice, 57.1% (n=112) for fruits, and 69.9% (n=137) for vegetables.

However, a majority, 73% (n=143) stated they *increased* their consumption of sugary snacks, and 40.3% (n=79) reported *increased* sugary drinks consumption. Food behavioural changes included: 50% (n=98) of respondents reported *skipping meals* and 45.4% (n=89) *increasing* their portion sizes. 54.6% (n=107) reported an *increased*

consumption of crisps and salty snacks and 40.8% (n=80) *increasing* takeaway foods.

Alcohol consumption *decreased* for 24.5% (n=48) of respondents, while 67.3% (n=132) reported *no change* in their alcohol intake. A Chi-Square test confirmed significant differences in consumption habits between the different food groups during the examination period ($p < 0.001$), indicating that these changes were unlikely to be random.

Table 3: Self-reported changes in food consumption patterns

Food group consumption	Increased (N, %)	Decreased (N, %)	No Change (N, %)
Dairy products	38 (19.4%)	19 (9.7%)	139 (70.9%)
Red meat	14 (7.1%)	29 (14.8%)	153 (78.1%)
Processed meats	39 (19.9%)	21 (10.7%)	136 (69.4%)
Poultry	27 (13.8%)	22 (11.2%)	147 (75.0%)
Fish and other seafood	11 (5.6%)	31 (15.8%)	154 (78.6%)
Sugary drinks	79 (40.3%)	10 (5.1%)	107 (54.6%)
Energy drinks	58 (29.6%)	10 (5.1%)	128 (65.3%)
Alcohol drinks	16 (8.2%)	48 (24.5%)	132 (67.3%)
Sugary snacks	143 (73.0%)	10 (5.1%)	43 (21.9%)
Crisps and salty snacks	107 (54.6%)	14 (7.1%)	75 (38.3%)
Fruits	52 (26.5%)	32 (16.3%)	112 (57.1%)
Vegetables	22 (11.2%)	37 (18.9%)	137 (69.9%)
Bread	57 (29.1%)	19 (9.7%)	120 (61.2%)
Pasta and rice	52 (26.5%)	13 (6.6%)	131 (66.8%)
Take-away food	80 (40.8%)	21 (10.7%)	95 (48.5%)
Meal skipping	98 (50.0%)	22 (11.2%)	76 (38.8%)
Portion size changes	89 (45.4%)	34 (17.3%)	73 (37.2%)

$\chi^2(32) = 608.74, p < 0.001$

3.4. Physical activity and weight changes

Prior to the examination period, nearly half of the respondents (47.5%, n=93) reported engaging in little to no physical activity, with 18.4% (n=36) not performing any physical activity at all, and 29.1% (n=57) engaging rarely. Among the remaining participants, physical activity occurred at varying frequencies, though only 4.6% (n=9) exercised daily.

During the examination period, 51.5% (n=101), indicated a decrease in physical activity, while only 7.1% (n=14) reported an increase. In terms of weight, over a third, 37.2% (n=73) experienced weight gain, with 41.3% (n=81) reporting no change, and 15.3% (n=30) reporting weight loss.

3.5. Sleep behaviours

76.0% of students, (n=159) reported habitual sleeping times of between 6 to 9 hours per night, while 17.9% (n=35) indicated they slept for less than 6 hours. Only a small percentage reported longer sleep durations, with 4.6% (n=9) sleeping for 9 to 12 hours and 1.5% (n=3) sleeping for more than 12 hours. When asked if examinations affected their sleep quality, most students (85.7%, n=168) selected the 'Yes' option, with 14.3% (n=28) reporting, not being affected.

3.6. Lifestyle and dietary behaviours and associations with demographic variables

Chi-squared tests on the following variables yielded the following results:

- **Association between age group and increased sugary drink consumption:** Younger students (18-25

years) were significantly more likely to increase their consumption of sugary drinks, while older students (26+ years) were more likely to report no change. ($\chi^2(4) = 12.518, p=0.014$).

- **Association between meal skipping and yearly income levels:** A majority of respondents earning low incomes (€0–€10,000), 56.2%, reported an increase in meal skipping during exams, 11.6% a decrease, and 32.2% no change. In the >€30,001 income group, 26.7% reported an increase, none reported a decrease, and 73.3% reported no change. ($\chi^2(6) = 14.189, p=0.028$)
- **Association between gender and changes in food portion sizes:** Among males, 26.8% reported an increase in portion sizes during exams, 22.0% a decrease, and 51.2% no change. Among females, 50.3% reported an increase, 16.1% a decrease, and 33.5% no change. ($\chi^2(2) = 7.293, p=0.026$)
- **Association between gender and changes in take-away food consumption:** Among males, 19.5% reported an increase in take-away food consumption during exams, 9.8% a decrease, and 70.7% no change. Among females, 46.5% reported an increase, 11% a decrease, with 42.6% reporting no change. ($\chi^2(2) = 11.111, p=0.004$)
- **Association between gender and sleep changes:** Participants were asked to indicate whether their sleep patterns changed during the examination period by responding 'Yes' or 'No'. Among those

surveyed, 68.3% of male respondents and 84.5% of female respondents answered 'Yes', demonstrating a statistically significant association between gender and sleep pattern changes during examinations. ($\chi^2(1) = 5.573, p=0.018$)

- **Association between weight changes and age group:** Weight gain during examination periods varied by age group, with 38.0% of individuals aged 18–25 years, 28.6% of those aged 26–40 years, and 41.2% of those over 40 years reporting weight gain. Weight loss and no change were least reported, particularly in the 40+ group where no weight loss was reported. However, these differences were not statistically significant. ($\chi^2(6) = 9.504, p=0.14$).

3.7. Perceived stress results

Results in Table 4 reveal the percentages of students reporting high levels of stress across various dimensions during the examination period. 42.3% (n=83) of respondents reported 'sometimes' feeling unable to control important things in their lives, while 29.1% (n=57) experienced this 'fairly often.' On the other hand, 37.2% (n=73) felt 'fairly often' confident in handling personal problems. Regarding perception of 'things not going their way', 41.8% (n=82) reported feeling this 'sometimes,' and 31.6% (n=62) agreed with 'fairly often.' Additionally, 24.5% (n=48) of students felt overwhelmed by difficulties 'very often,' with 24.0% (n=47) reporting this feeling 'fairly often'.

Table 4: Results on self-perceived stress levels in students (utilising the PSS-4 scale)

In the past 2 weeks, how often have you felt:		Never	Almost never	Sometimes	Fairly often	Very often
Unable to control the important things in life	N	5	21	83	57	30
	%	2.6%	10.7%	42.3%	29.1%	15.3%
Confident about your ability to handle personal problems	N	6	25	70	73	22
	%	3.1%	12.8%	35.7%	37.2%	11.2%
Things were not going your way	N	3	12	82	62	37
	%	1.5%	6.1%	41.8%	31.6%	18.9%
Difficulties were piling up so high you could not overcome them	N	10	29	62	47	48
	%	5.1%	14.8%	31.6%	24.0%	24.5%

3.8. Perceived influence of stress on eating habits results during the examination period

Participants were also asked whether the stress during the examination period affected their eating habits. A combined 61.2% of students reported that their stress levels affected their eating habits either 'fairly often' (26.0%, $n=51$) or 'very often' (35.2%, $n=69$). Additionally, 25.0% ($n=49$), reported this happened 'sometimes'. A low percentage, 4.1% ($n=8$), reported that their eating was 'never' affected, and a further 9.7% ($n=19$) 'nearly never' felt that stress affected their eating habits during the examination period.

4. Discussion

This cross-sectional study explored dietary and other lifestyle habits in University of Malta students and any changes to these habits during one examination period in early 2024. A total of 196 respondents returned the survey. Most respondents were Maltese, female students, following an undergraduate full-time course within the age range of 18 to 25 years old. This study found some significant dietary and lifestyle changes during this period with the implications being discussed in the sections below.

4.1. Dietary changes during examination periods

Increased consumption of sugary snacks (73%), crisps and salty snacks (54.6%), and takeaway food (40.8%), reflect an increased reliance on convenience foods. Similarly, a Korean cross-sectional study (Choi, 2020), reported similar significant trends in food consumption changes such as increased meal skipping ($p < 0.05$ for dinner) and overeating ($p < 0.01$), during exams. On the other hand, Faixová et al. (2023) found that only a quarter of students, 25.2% ($n=148$), ate more during examination periods, whilst almost half ($n=281$) said they ate less. Any disruptions in regular eating patterns could impact both well-being and academic performance in the longer term and is an area which needs to be addressed (Burrows et al., 2017).

Staple food consumption showed some variations. Bread intake increased for over a quarter of students, with pasta and rice consumption following a similar trend. For fruit consumption 16.3% reduced intake, and 57.1% reported no change. Vegetable consumption had the highest decrease in consumption (18.9%), suggesting

that some students may have deprioritised healthier foods in favour of more convenience-type items, a pattern also observed in the cross-sectional study carried out by Michels et al. (2020). This reduction in fruit and vegetable intake can be of concern, given this collective food group's role in supporting cognitive function and stress resilience (Faixová et al., 2023). According to Malta's national dietary guidelines, individuals are advised to consume at least three portions of vegetables and two portions for fruit to support overall health and well-being (Ministry for Health, Malta, 2015).

Minimal changes in alcohol consumption were reported during exams, with 67.3% reporting no change. Since no units or quantities of alcohol were measured, a risk factor cannot be established; however, although only a small number of students reported an increase, this is still of concern for this minority and needs to be addressed. Alcohol consumption in university students has been linked to negative academic and health outcomes (Castaño-Perez & Calderon-Vallejo, 2014).

Younger students (18-25 years) were more likely to increase sugary drink intake than older students (26+ years, $p=0.014$). This result may reflect multiple underlying causes and associated consequences, such as younger students being less resilient to increased academic and social pressures (Almoraie et al., 2024), have limited strategies for coping with stress, or be more affected by marketing and peer behaviours that encourage sugary beverage consumption (Almoraie et al., 2024; Choi, 2020). Additionally, younger students may have more irregular eating patterns or limited access to nutritious alternatives, making sugary drinks a convenient energy boost during long study sessions (Sogari et al. 2018). In fact, in this study, students in the lowest income bracket (€0-10,000) reported to be significantly more likely to skip meals, which could be due to financial constraints also reported in other international studies (Errisuriz et al., 2016; Mikolajczyk et al., 2009).

In this study, females were more likely to increase takeaway food intake ($p = 0.004$). In contrast, Choi's (2020) study found that male students consumed fast food more often than females during exams ($p < 0.05$). The greater number of female participants in this local study could explain these mixed results, suggesting that participant sample composition may play a role in observed eating behaviours. One plausible explanation for the results obtained in this local study is that female students may turn to take-away food during exams as a coping strategy, possibly due to higher stress levels and

time constraints (Barbayannis et al., 2022). Studies also show that females are more prone to both increases and decreases in food intake in response to stress (Choi, 2020; Faixová et al., 2023).

4.2. Physical activity and sleep disruptions

Half of the participants normally performed minimal or no physical activity with 51.5% reporting decreases in their physical activity during examination periods. This finding aligns with a Spanish cross-sectional study involving 742 students (Monserrat-Hernández et al., 2023), who reported a decline in physical activity and concluded that academic stress variably affects students' physical activity levels. In their study, they also noted that some students increased physical activity in response to stress suggesting mixed responses. Students who kept regular physical activity showed significantly lower stress levels, indicating a protective effect of exercise against academic stress ($p < 0.001$) (Monserrat-Hernández et al., 2023).

Similarly, Choi (2020) found that decreased physical activity is linked with higher stress levels ($p < 0.05$). This decrease could be due to greater time constraints inflicted by exams, driving students to prioritise studying over exercise. Poor time management may also lead to this trend, as students grapple to balance academic demands with health maintenance (Sogari et al., 2018). Given the established link between exercise and stress reduction, promoting physical activity as a coping mechanism is critical (Firth et al., 2020; Fukuie et al., 2024), future research could explore how structured exercise interventions impact stress management in university students.

For sleep behaviours, our study reported the vast majority experiencing changes in sleep quality. Females were more likely to be affected during examination periods compared to their male peers ($p=0.018$). The National Sleep Foundation recommends at least 7 to 9 hours of sleep per night (Hirshkowitz et al., 2015), and therefore most of the students in this local study did follow the recommended guidelines. Similarly, a Spanish cross-sectional study by Díaz et al., (2023) revealed that from 191 female undergraduate students, 82% reported disruptions in their sleep schedules during examination periods.

4.3. BMI and weight changes during examinations

The BMI levels of some students in our study fell in the overweight and obese categories placing them at higher risk for non-communicable diseases (NCDs) such as cardiovascular conditions (WHO, 2025). During the examination period, both weight gain and weight loss was reported which could reflect the changes reported in physical activity, meal portion sizes, and frequency of consumption of certain food groups or eating behaviours. Other studies report weight fluctuations such as the study by Faixová et al. (2023), where 50% of medical students lost weight. These short-term fluctuations warrant having support structures, including health promotion initiatives targeting students to avoid this scenario from taking place. In fact, a longitudinal study by Deliens et al. (2019) in Belgium found significant weight and body composition changes over 4.5 years, with male students gaining an average of 5.7 kg and females 2.2 kg, particularly during their first and final academic years.

4.4. Perceived stress during examinations

A significant number of students reported feeling stressed during exams, particularly experiencing a lack of control and being overwhelmed by challenges. While some maintained confidence in handling personal problems, the overall findings reflect perceived stress. A majority of students also reported stress directly affecting their eating habits.

These findings may suggest that examination periods are related to a greater prevalence of stress among students. Additionally, it emphasises the impact of stress on students' confidence in managing stress, and managing their daily life, including their eating behaviours. Michels et al. (2020) also emphasised stress during examinations as a first-hand influencer of eating behaviours, potentially exacerbating poor dietary choices.

4.5. Recommendations for practice

This study has highlighted the need for support systems and environments during specific periods when stress is more likely to occur, like examination periods. Whilst general health promotion advice is generally widely available, targeted advice on diet, physical activity and sleep addressing examination times is not widely offered. Collaboration among government, policymakers, and university groups is recommended.

Health promotion and community support such as the availability of professional resources with targeted advice on recommended healthy eating behaviour tips, sleep hygiene practices and physical activity breaks should be easily accessible and available to students. Student-led talks and forums, supported by universities and student associations, could promote engagement and sharing of coping strategies, enhancing both well-being and academic success.

4.6. Recommendations for further research

The study was a small-scale cross-sectional study looking primarily at lifestyle behaviour changes during examination periods. A longitudinal study could provide deeper insights into how stress and dietary behaviours fluctuate over time and is recommended for future research implementation. Further exploratory work, such as semi-structured interviews, could explore further students' perceptions and challenges during examination periods and how this leads to lifestyle behaviour changes. Future research should incorporate more in-depth analysis using full PSS-4 scoring to reflect the overall construct measures by the scale as well as reliability analysis. Interdisciplinary work with psychological perspectives investigated deeper, in collaboration with professionals with mental health qualifications and expertise, is therefore recommended.

Future research could track changes in diet, stress, and coping over time, and test interventions like stress management and tailored nutrition strategies. Studying diverse student groups across different universities and tertiary education provider settings and using mixed methods (quantitative and qualitative approaches) would deepen understanding and address current gaps, improving health support and academic policies.

To support students in managing academic stress, targeted interventions—such as stress management programmes and tailored nutritional guidance based on gender, income, and age are recommended to promote healthier habits and coping strategies.

4.7. Strengths

This study used a cross-sectional survey-style design which allowed the participants easy and anonymous online access, convenient and quick data collection, therefore potentially reducing social desirability bias. Self-reporting preserves anonymity and provides fast

results without the need for trained technical personnel to carry out the fieldwork, an example being the BMI methodology being widely used in international studies particularly in young adults (Olfert et al., 2018). Consequently, this design allowed a snapshot of student behaviours during a critical period, with an indicative sample size of the student population.

4.8. Limitations

This study has some limitations. The use of convenience sampling and a female-skewed, mostly young adult sample, limits generalisability. Its cross-sectional design prevents causal conclusions, and reliance on self-reported data introduces potential recall and reporting biases. The BMI results in this study were based on self-reported height and weight. Participants may often under/overestimate their weight and their height, potentially leading to misclassification of BMI categories and influencing the observed associations. There are many reasons for this occurrence, which could include the use of inaccurate scales to measure weight. Dietary intakes lacked portion size detail, and statistical analysis was limited to basic tests.

4.9. Conclusions

This study provides valuable insight into how examination periods affect the dietary and lifestyle behaviours of Maltese university students, highlighting increased consumption of unhealthy snacks, reduced physical activity, and disrupted sleep. These patterns may have long-term implications for students' overall wellness.

To translate these findings into practice, universities and related institutions can implement evidence-based strategies to support healthy habits during high-stress periods. Examples include promoting access to more nutritious food options on campus, and encouraging regular physical activity by implementing more campus activities promoting health and wellbeing, providing further guidance on balanced diets through targeted education campaigns using the widely active university or faculty/departmental social media platforms as well as carrying out collaborations with university associations, and creating wellness initiatives that help students maintain consistent lifestyle routines.

Incorporating these approaches into institutional policies such as food procurement can foster healthier

behaviours, enhance student wellbeing, and serve as a model for future interventions in similar educational settings.

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Conflicts of interest

The authors report no conflicts of interest.

References

- Almoraie, N. M., Alothmani, N. M., Alomari, W. D., & Al-amoudi, A. H. (2024). Addressing nutritional issues and eating behaviours among university students: A narrative review. *Nutrition Research Reviews*, 38(1), 53-68. <https://doi.org/10.1017/s0954422424000088>
- Barbayannis, G., Bandari, M., Zheng, X., Baquerizo, H., Pecor, K. W., & Ming, X. (2022). Academic stress and mental well-being in college students: Correlations, affected groups, and COVID-19. *Frontiers in Psychology*, 13, 886344. <https://doi.org/10.3389/fpsyg.2022.886344>
- Bouloukaki, I., Tsiligianni, I., Stathakis, G., Fanaridis, M., Koloi, A., Bakiri, E., Moudatsaki, M., Pouladaki, E., & Schiza, S. (2023). Sleep quality and fatigue during exam periods in University students: Prevalence and associated factors. <https://www.mdpi.com/2227-9032/11/17/2389>
- Burrows, T., Whatnall, M., Patterson, A., & Hutchesson, M. (2017). Associations between dietary intake and academic achievement in college students: A systematic review. *Healthcare*, 5(4), 60. <https://doi.org/10.3390/healthcare5040060>
- Castaño-Perez, G. A., & Calderon-Vallejo, G. A. (2014). Problems associated with alcohol consumption by university students. *Revista Latino-Americana de Enfermagem*, 22(5), 739-746. <https://doi.org/10.1590/0104-1169.3579.2475>
- Chao, A. M., Jastreboff, A. M., White, M. A., Grilo, C. M., & Sinha, R. (2017). Stress, cortisol, and other appetite-related hormones: Prospective prediction of 6-month changes in food cravings and weight. *Obesity*, 25(4), 713-720. <https://doi.org/10.1002/oby.21790>
- Choi, J. (2020). Impact of stress levels on eating behaviors among college students. *Nutrients*, 12(5), 1241. <https://doi.org/10.3390/nu12051241>
- Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior*, 24(4), 385. <https://doi.org/10.2307/2136404>
- Deliens, T., Deforche, B., Chapelle, L., & Clarys, P. (2019). Changes in weight and body composition across five years at university: A prospective observational study. *PLOS ONE*, 14(11), e0225187. <https://doi.org/10.1371/journal.pone.0225187>
- Díaz, G., Hernández, S., Crespo, A., Renghea, A., Yébenes, H., & Iglesias-López, M. T. (2023). Macronutrient intake, sleep quality, anxiety, adherence to a Mediterranean diet and emotional eating among female health science undergraduate students. *Nutrients*, 15(13), 2882. <https://doi.org/10.3390/nu15132882>
- Errisuriz, V. L., Pasch, K. E., & Perry, C. L. (2016). Perceived stress and dietary choices: The moderating role of stress management. *Eating Behaviors*, 22, 211-216. <https://doi.org/10.1016/j.eatbeh.2016.06.008>
- Faixová, D., Jurinová, Z., Faixová, Z., Kyselovič, J., & Gažová, A. (2023). Dietary changes during the examination period in medical students. *EAS Journal of Pharmacy and Pharmacology*, 5(03), 78-86. <https://doi.org/10.36349/easjpp.2023.v05i03.006>
- Firth, J., Gangwisch, J. E., Borsini, A., Wootton, R. E., & Mayer, E. A. (2020). Food and mood: How do diet and nutrition affect mental wellbeing? *British Medical Journal*, m2382. <https://doi.org/10.1136/bmj.m2382>
- Fukuie, T., Inoue, K., & Yamaguchi, A. (2024). Lifestyle and well-being of university students in Japan: A cross-sectional study. *Academia Mental Health and Well-Being*, 1(2). <https://doi.org/10.20935/mhealthwellb7327>
- Hirshkowitz, M., Whiton, K., Albert, S. M., Alessi, C., Bruni, O., DonCarlos, L., Hazen, N., Herman, J., Katz, E. S., Kheirandish-Gozal, L., Neubauer, D. N., O'Donnell, A. E., Ohayon, M., Peever, J., Rawding, R., Sachdeva, R. C., Setters, B., Vitiello, M. V., Ware, J. C., ... Adams Hillard, P. J. (2015). National sleep Foundation's sleep time duration recommendations: Methodology and results summary. *Sleep Health*, 1(1), 40-43. <https://doi.org/10.1016/j.sleh.2014.12.010>

- Jacques, A., Chaaya, N., Beecher, K., Ali, S. A., Belmer, A., & Bartlett, S. (2019). The impact of sugar consumption on stress driven, emotional and addictive behaviors. *Neuroscience & Biobehavioral Reviews*, 103, 178-199. <https://doi.org/10.1016/j.neubiorev.2019.05.021>
- Macht, M. (2008). How emotions affect eating: A five-way model. *Appetite*, 50(1), 1-11. <https://doi.org/10.1016/j.appet.2007.07.002>
- Michels, N., Man, T., Vinck, B., & Verbeyst, L. (2020). Dietary changes and its psychosocial moderators during the university examination period. *European Journal of Nutrition*, 59(1), 273-286. <https://doi.org/10.1007/s00394-019-01906-9>
- Ministry for Health, Health Promotion and Disease Prevention Directorate. (2015). *Dietary Guidelines for Maltese Adults: Healthy Eating the Mediterranean Way!* Retrieved May 2024, from https://hpd.gov.mt/sites/default/files/2023-06/healthy%20guide%20Cover%20HI_o.pdf
- Mikolajczyk, R. T., El Ansari, W., & Maxwell, A. E. (2009). Food consumption frequency and perceived stress and depressive symptoms among students in three European countries. *Nutrition Journal*, 8(1). <https://doi.org/10.1186/1475-2891-8-31>
- Monserat-Hernández, M., Checa-Olmos, J. C., Arjona-Garrido, Á., López-Liria, R., & Rocamora-Pérez, P. (2023). Academic stress in University students: The role of physical exercise and nutrition. *Healthcare*, 11(17), 2401. <https://doi.org/10.3390/healthcare11172401>
- Olfert, M. D., Barr, M. L., Charlier, C. M., Famodu, O. A., Zhou, W., Mathews, A. E., ... & Colby, S. E. (2018). Self-reported vs. measured height, weight, and BMI in young adults. *International Journal of Environmental Health*, 15(10), 2216. <https://doi.org/10.3390/ijerph15102216>
- Serlachius, A., Hamer, M., & Wardle, J. (2007). Stress and weight change in university students in the United Kingdom. *Physiology & Behavior*, 92(4), 548-553. <https://doi.org/10.1016/j.physbeh.2007.04.032>
- Smiley, J. D. (2022). *High amounts of salty foods could double stress levels, study finds*. Medical News Today. Retrieved January 2025, from <https://www.medicalnewstoday.com/articles/high-amounts-salty-processed-foods-could-double-stress-levels>
- Sogari, G., Velez-Argumedo, C., Gómez, M. I., & Mora, C. (2018). College students and eating habits: A study using an ecological model for healthy behavior. *Nutrients*, 10(12), 1823. <https://doi.org/10.3390/nu10121823>
- Torres, S. J., & Nowson, C. A. (2007). Relationship between stress, eating behavior, and obesity. *Nutrition*, 23(11-12), 887-894. <https://doi.org/10.1016/j.nut.2007.08.008>
- Vallejo, M. A., Vallejo-Slocker, L., Fernández-Abascal, E. G., & Mañanes, G. (2018). Determining factors for stress perception assessed with the perceived stress scale (PSS-4) in Spanish and other European samples. *Frontiers in Psychology*, 9, 37. <https://doi.org/10.3389/fpsyg.2018.00037>
- White, P. H., & McManus, M. (2015). Investing in the health and well-being of young adults. *Journal of Adolescent Health*, 57(1), 126. <https://doi.org/10.1016/j.jadohealth.2015.04.005>
- Walker-Harding, L. R., Christie, D., Joffe, A., Lau, J. S., & Neinstein, L. (2017). Young adult health and well-being: a position statement of the Society for Adolescent Health and Medicine. *Journal of Adolescent Health*, 60(6), 758-759. <https://doi.org/10.1016/j.jadohealth.2017.03.021>
- World Health Organization (WHO). (2025 September 25). *Non communicable diseases*. Retrieved June 2026, from <https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases>

Commentary

Revising Alcohol Consumption Guidelines: Exploring the implications of new initiatives for Canada, Ireland and Malta

Frank Houghton

Department of Applied Social Sciences, Technological University of the Shannon, Limerick, Ireland

Abstract

Alcohol remains a serious threat to public health in many countries, including both Europe and North America. This brief commentary examines current alcohol drinking guidelines in Ireland, Malta and Canada, before examining new advice that has emerged from the Canadian Centre on Substance Use and Addiction (CCSA). The CCSA guideline suggests that only total abstinence from alcohol can achieve the elimination of all alcohol related cancer risk to the consumer. This guideline is in line with a recent guideline from the World Health Organisation (WHO) and the International Agency for Research on Cancer (IARC). It is suggested that the CCSA guideline achieve wider international adoption. However, the CCSA pictogram conveying this message is critiqued for its choice of colours, on the basis of both colour blindness, and the Western cultural associations of the colour green.

Keywords: alcohol; health promotion; healthy drinking guidelines; Ireland; Canada; Malta

Alcohol is a significant commercial determinant of health (CDoH) and substantial threat to mortality, morbidity and wellbeing globally (Brauer et al., 2024; Cook et al., 2024; Murray et al., 2020; WHO Regional Office for Europe, 2024; World Health Organization, 2024a). However, for many years this threat, and particularly the threat of cancer has been under-estimated, at least

in public consciousness (Stockwell & Hobin, 2023). This issue is a particular concern for Europe, given that it is the region with the highest alcohol consumption globally (WHO Regional Office for Europe, 2024; World Health Organization, 2024a).

The misperception over the true adverse impact of alcohol is not accidental. Big Alcohol, having learned from the Big Tobacco playbook, have worked hard to manipulate both the public and policy makers (Glantz et al., 1997; Kluger, 1997; Proctor, 2011; Stockwell & Hobin, 2023; White, 1988). The Wine, Beer and Spirit industry lobbies within the European Union (EU) have been particularly successful at safeguarding their commercial interests. Evidence of this can be seen in the specific EU legislative exemption for alcohol products from having to display even basic ingredients information on packaging, let alone health warnings (European Commission, n.d.).

However, Europe's Beating Cancer Plan helped to break the alcohol industry's control that denied and downplayed the alcohol – cancer link (European Commission, 2022). Although the attention of the European Commission (EC) has since turned to focus on issues such as security and competitiveness, this knowledge has become a focus for alcohol control and public health advocates (Alcohol Action Ireland, 2025; US Surgeon General, 2025). In 2023, the World Health Organization (WHO) and the International Agency for Research on Cancer (IARC) issued a joint statement stating, '*No safe amount of alcohol consumption for cancers can be established*' (Kluge & Weiderpass, 2023).

This statement has important implications for many countries, including Canada, Ireland and Malta. Table 1 is based on extracts from the WHO's recent report on the global status report on alcohol (World Health Organization, 2024a). As well as examining consumption,

Correspondence to Frank Houghton

frank.Houghton@tus.ie

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this report specifically examines health issues. It is clear from Table 1 that of the three countries listed here, Ireland appears to have the most problematic relationship with alcohol, including not only total alcohol consumption and the percentage of drinkers in the population, but also of concern is the percentage of young people (15-19

years) that are drinkers. Ireland has long been known to have an ‘uneasy’ relationship with alcohol at a societal level (Houghton & Houghton, 2013). However, based on this data, Malta also has notably higher rates of youth drinking and heavy episodic drinking (HED) than Canada (World Health Organization, 2024b).

Table 1: Alcohol consumption in Canada, Ireland and Malta (WHO, 2024c)

	Canada	Ireland	Malta
Alcohol per capita consumption in litres of pure alcohol (CIs)			
Total	9.9 (6.8, 13.0)	11.7 (8.6, 1.9)	8.5 (5.3, 11.5)
Males	15.6 (10.6, 20.5)	18.1 (13.3, 23.0)	13.0 (8.1, 17.6)
Females	4.3 (2.9, 5.8)	5.6 (3.9, 7.5)	3.8 (2.3, 5.2)
Percentage of current drinkers in population (CIs)			
Total	69.4 (68.1, 70.7)	83.4 (82.2, 84.6)	79.0 (77.9, 80.1)
Males	77.6 (76.5, 78.8)	88.3 (87.3, 89.2)	86.0 (85.2, 86.8)
Females	61.4 (59.9, 62.9)	78.8 (77.2, 80.2)	71.6 (70.2, 73.0)
Heavy episodic drinking (HED) in the population (percentage & CIs)			
Total	28.4 (26.8, 30.1)	45.7 (43.1, 48.3)	43.0 (41.1, 44.9)
Males	39.3 (37.3, 41.2)	58.2 (55.4, 60.9)	55.4 (53.3, 57.4)
Females	17.1 (15.8, 18.4)	33.6 (31.1, 36.1)	38.7 (27.0, 30.5)
Current drinkers, 15-19 years (percentage & CIs)			
Total	54.9 (52.3, 57.6)	74.4 (71.9, 76.7)	65.3 (62.6, 67.7)
Males	57.2 (54.7, 59.9)	76.1 (73.7, 78.4)	67.5 (65.0, 69.9)
Females	52.5 (49.8, 55.1)	72.6 (70.1, 74.9)	62.9 (60.1, 65.4)

As countries redefine healthy drinking guidelines it is important that this information is incorporated into such advice. Ireland, for example, has announced that the Health Information and Quality Authority (HIQA) will be revising its low-risk drinking guidelines in 2026 (Hospital Information and Quality Authority, 2025). This is important as research indicates that current drinking guidelines are lacking (Houghton & O'Mahony, 2022). The current official Irish Government guidelines for alcohol consumption are detailed in Table Two.

Table 2: Alcohol Consumption Guidelines from Canada, Ireland & Malta

Canada	Ireland	Malta
The guidelines for consumption limits Women: limit alcohol to no more than: 2 standard drinks per day 10 standard drinks per week 3 standard drinks on special occasions avoid drinking alcohol on some days Men: limit alcohol to no more than: 3 standard drinks per day 15 standard drinks per week 4 standard drinks on special occasions avoid drinking alcohol on some days Pregnant women: avoid drinking alcohol Youth, with parental consent: limit alcohol to: no more than twice weekly no more than 1 or 2 standard drinks each time	Weekly low-risk alcohol guidelines The low-risk alcohol guidelines are that you do not drink more than: 11 standard drinks per week, if you are a woman 17 standard drinks per week, if you are a man Spread your drinks out across the week. Have at least 2 to 3 alcohol-free days per week. Do not drink more than 6 standard drinks on any 1 occasion. The less you drink the lower your risk of developing alcohol-related health issues.	Drinking more than 4 standard drinks in a single day, or drinking more than 14 standard drinks over the course of a week is considered heavy alcohol use. Heavy alcohol use is dangerous. Avoid it. If you do not drink, it is recommended that you do not to start drinking at all.
(Government of Canada, 2021)	(Health Services Executive, 2025)	(Health Promotion & Disease Prevention Directorate, 2025)

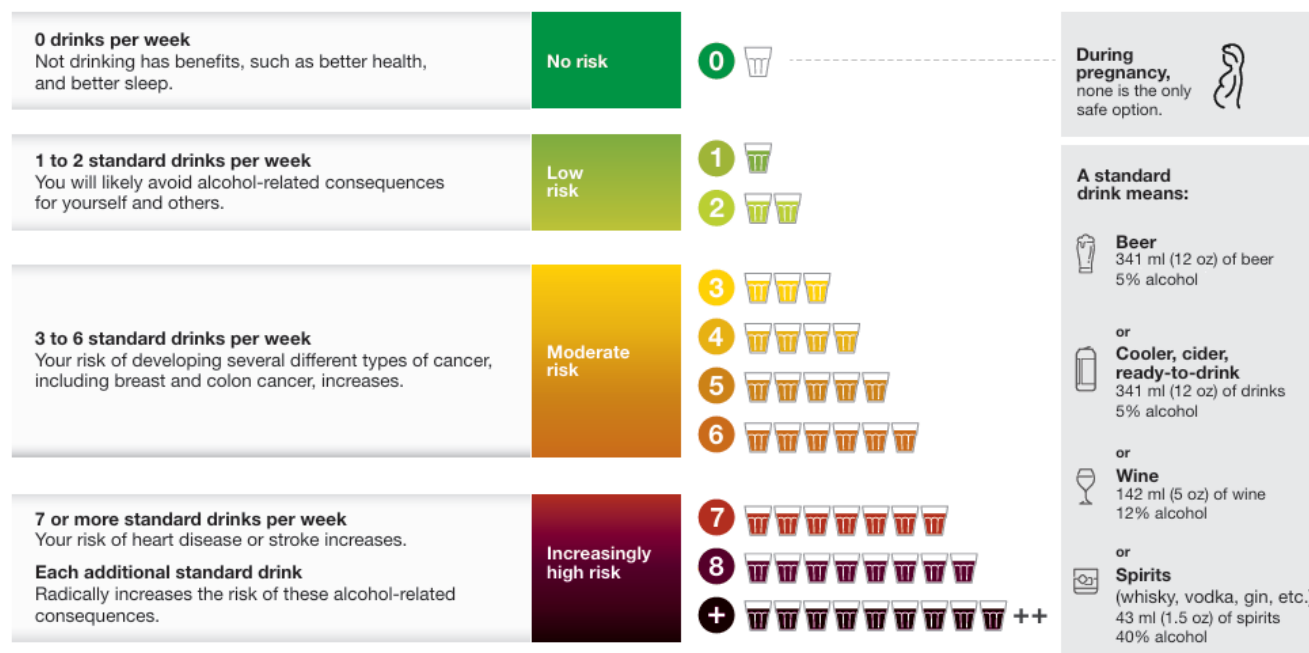
Table Two also details drinking the official alcohol drinking guidelines for Canada, as well as alcohol consumption advice from Malta's Health Promotion & Disease Prevention Directorate. It must be noted that the definition of a standard drink differs between jurisdictions. In Malta, like the UK, a standard drink is 8g of pure alcohol, while in Ireland it is 10g of alcohol, and in Canada it is 13.45g of pure alcohol.

It is notable that the Maltese HPDPD advice appears to focus specifically on heavy drinking use as dangerous, effectively ignoring dangers of lower levels of alcohol consumption. Despite prior reluctance on the part of the Irish Government to take a lead on alcohol control and missed opportunities in this field (Houghton, 2010, 2012, 2013), it seems certain that when HIQA completes its report in 2026 the guidelines for alcohol consumption in Ireland will decrease. The question is by how much, and how will the risks be framed? As can be seen from Table One, although the current Canadian Government advice is generally (with the exception of youth use) in line with Irish and Maltese (HPDPD) guidelines, the Canadian Centre on Substance Use and Addiction (CCSA) now recommends significantly lower guidelines (Canadian

Centre on Substance Use and Addiction, 2023). These are outlined in Figure One.

Alcohol consumption per week

Drinking alcohol has negative consequences. The more alcohol you drink per week, the more the consequences add up.



Aim to drink less

Drinking less benefits you and others. It reduces your risk of injury and violence, and many health problems that can shorten life.

It's time to pick a new target

What will your weekly drinking target be?



Figure 1. Canadian Centre on Substance Use and Addiction Alcohol Consumption Guidelines (Canadian Centre on Substance Use and Addiction, 2023) Reproduced with permission from the Canadian Centre on Substance Use and Addiction

The CCSA recommendation of low-risk drinking guidelines being just one or two standard drinks or less per week will no doubt be fiercely challenged by the global alcohol industry and their proxy social aspects and public relations organizations (SAPROs) (Miller et al., 2011; Petticrew et al., 2018). However, alcohol remains a significant threat to health, including carcinogenic properties (Kluge & Weiderpass, 2023). The 'no safe amount' of alcohol message refers specifically to cancer outcomes, and it must be acknowledged that guideline-setting typically balances multiple endpoints and population-level communication goals. The adoption of the CCSA's revised and lower guidelines should be considered.

It must be acknowledged though that the colour coding of low-risk drinking in the Canadian Centre on Substance Use and Addiction infographic is similar to Nutri-Score and Traffic Light health warning labels that are increasingly widely used (Hercberg et al., 2022; Houghton, 2012; Merz et al., 2024; Sadeghi et al., 2024; Song et al., 2021). However, the CCSA infographic is potentially problematic in two ways and should be amended. Firstly, the colour green has connotations of health, security, vitality and being natural (Schuldt, 2013; Won & Westland, n.d.). Perhaps more importantly, green often symbolises go (Danacilar, 2025). Its use in an alcohol guideline context for any level of alcohol consumption above zero is inappropriate. Therefore, it is suggested that the CCSA guidelines and infographic

be adopted, but that the colour coding of the low-risk category be changed to yellow, rather than green. Such a move is important for the denormalisation of alcohol consumption. Secondly, given the prevalence of Red-Green colour blindness, especially among males, perhaps an alternate spectrum of colour might be adopted (Allred et al., 2014).

Alcohol continues to pose a significant global threat to mortality, morbidity and wellbeing. Countries such as Ireland, Malta and Canada are no exception. However, alcohol consumption advice within these states fails to adequately inform the public of the cancer risks associated with alcohol. Countries therefore need to amend their alcohol consumption guidelines to reflect knowledge about the manifold harms caused by alcohol, including cancer. No risk guidelines must, by definition therefore, relate only to zero alcohol consumption. Low risk guidelines must similarly be vastly reduced from current guidelines. It is suggested that countries consider adopting the CCSA guidelines. However, visual portrayals of such advice, such as the CCSA pictogram, should be modified both to assist people who are colour blind and to better indicate mild risk from cancer.

Conflicts of Interest

The author reports no conflicts of interest.

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References

- Alcohol Action Ireland. (2025). Alcohol and cancer. *Alcohol Action Ireland*. <https://alcoholireland.ie/facts-about-alcohol/alcohol-and-cancer/>
- Allred, S. C., Schreiner, W. J., & Smithies, O. (2014). Still too many red-green figures. *Nature*, 510(7505), 340–340. <https://doi.org/10.1038/510340e>
- Brauer, M., Roth, G. A., Aravkin, A. Y., Zheng, P., Abate, K. H., Abate, Y. H., Abbasfati, C., Abbasgholizadeh, R., Abbasi, M. A., Abbasian, M., Abbasifard, M., Abbasi-Kangevari, M., Abd ElHafeez, S., Abd-Elsalam, S., Abdi, P., Abdollahi, M., Abdoun, M., Abdulah, D. M., Abdullahi, A., ... Gakidou, E. (2024). Global burden and strength of evidence for 88 risk factors in 204 countries and 811 subnational locations, 1990–2021: A systematic analysis for the Global Burden of Disease Study 2021. *The Lancet*, 403(10440), 2162–2203. [https://doi.org/10.1016/S0140-6736\(24\)00933-4](https://doi.org/10.1016/S0140-6736(24)00933-4)
- Canadian Centre on Substance Use and Addiction. (2023). Retrieved February 21, 2026 from <https://www.ccsa.ca/en/canadas-guidance-alcohol-and-health-public-summary-drinking-less-better-infographic>
- Cook, M., Critchlow, N., O'Donnell, R., & MacLean, S. (2024). Alcohol's contribution to climate change and other environmental degradation: A call for research. *Health Promotion International*, 39(1), daae004. <https://doi.org/10.1093/heapro/daae004>
- Danacilar, İ. A. (2025). The effects of gender representation in advertising on consumer behavior and social norms: A semiotic analysis. *New Era International Journal of Interdisciplinary Social Researches*, 10(27), 1–20. <https://doi.org/10.5281/ZENODO.14940313>
- European Commission. (n.d.). *Alcohol labelling—Food Safety—European Commission*. Retrieved February 20, 2026, from https://food.ec.europa.eu/food-safety/labelling-and-nutrition/food-information-consumers-legislation/alcohol-labelling_en
- European Commission. (2022). *Europe's Beating Cancer Plan*. https://doi.org/10.1163/2210-7975_HRD-4679-0058
- Glantz, S., Slade, J., Bero, L., Hanauer, P., & Barnes, D. (1997). *The Cigarette Papers*. University of California Press. <http://doi.org/10.1525/9780520920996>
- Government of Canada. (2021, July 5). *Low-risk alcohol drinking guidelines* [Education and awareness]. Retrieved February 26, 2026, from <https://www.canada.ca/en/health-canada/services/substance-use/alcohol/low-risk-alcohol-drinking-guidelines.html>
- Health Promotion & Disease Prevention Directorate. (2025). *Alcohol*. Retrieved February 26, 2026, from <https://hpd.gov.mt/hpu/alcohol>
- Hercberg, S., Touvier, M., & Salas-Salvado, J. (2022). The Nutri-Score nutrition label: A public health tool based on rigorous scientific evidence aiming to improve the nutritional status of the population. *International Journal for Vitamin and Nutrition Research*, 92(3–4), 147–157. <https://doi.org/10.1024/0300-9831/a000722>
- Hospital Information and Quality Authority. (2025). *HIQA to estimate the risk of alcohol-related hospital admission and mortality associated with different levels of alcohol consumption*. Retrieved February 26, 2026, from <https://www.hiqa.ie/hiqa-news-updates/hiqa->

- estimate-risk-alcohol-related-hospital-admission-and-mortality-associated
- Houghton, F. (2010). A missed opportunity: Alcohol excise duty, RSA and trace-back. *Irish Journal of Psychological Medicine*, 27(1), 49–49. <https://doi.org/10.1017/S079096670000094X>
- Houghton, F. (2012). A Perfect Demonstration of the Absence of Leadership: Alcohol Policy in Ireland. *Irish Journal of Psychological Medicine*, 29(3), 145–146. <https://doi.org/10.1017/S079096670001716X>
- Houghton, F. (2013). Avoiding action: Ireland, alcohol, intoxication and workplace safety. *Irish Journal of Medical Science*, 182(3), 529–530. <https://doi.org/10.1007/s11845-012-0883-9>
- Houghton, F., & Houghton, S. (2013). Ireland and Alcohol: An Uneasy Relationship. In *Ireland: Economic, Political and Social Issues* (pp. 77–92). Nova Publishers.
- Houghton, F., & O'Mahony, C. (2022). Ireland's inadequate alcohol warning labelling legislation. *Irish Journal of Medical Science* (1971 –), 191(5), 2263–2265. <https://doi.org/10.1007/s11845-021-02831-9>
- Kluge, H., & Weiderpass, E. (2023). *Joint statement by WHO/Europe and IARC to the European Parliament – raising awareness of the link between alcohol and cancer*. Retrieved February 26, 2026, from <https://www.who.int/europe/news/item/06-11-2023-joint-statement-by-who-europe-and-iarc-to-the-european-parliament--raising-awareness-of-the-link-between-alcohol-and-cancer>
- Kluger, R. (1997). *Ashes to ashes: America's hundred-year cigarette war, the public health, and the unabashed triumph of Philip Morris* (1st Vintage Books ed). Vintage Books.
- Merz, B., Temme, E., Alexiou, H., Beulens, J. W. J., Buyken, A. E., Bohn, T., Ducrot, P., Falquet, M.-N., Solano, M. G., Haidar, H., Infanger, E., Kühnelt, C., Rodríguez-Artalejo, F., Sarda, B., Steenbergen, E., Vandevijvere, S., & Julia, C. (2024). Nutri-Score 2023 update. *Nature Food*, 5(2), 102–110. <https://doi.org/10.1038/s43016-024-00920-3>
- Miller, P. G., De Groot, F., McKenzie, S., & Droste, N. (2011). Vested interests in addiction research and policy. Alcohol industry use of social aspect public relations organizations against preventative health measures. *Addiction*, 106(9), 1560–1567. <https://doi.org/10.1111/j.1360-0443.2011.03499.x>
- Murray, C. J. L., Aravkin, A. Y., Zheng, P., Abbafati, C., Abbas, K. M., Abbasi-Kangevari, M., Abd-Allah, F., Abdelalim, A., Abdollahi, M., Abdollahpour, I., Abegaz, K. H., Abolhassani, H., Aboyans, V., Abreu, L. G., Abrigo, M. R. M., Abualhasan, A., Abu-Raddad, L. J., Abushouk, A. I., Adabi, M., ... Lim, S. S. (2020). Global burden of 87 risk factors in 204 countries and territories, 1990–2019: A systematic analysis for the Global Burden of Disease Study 2019. *The Lancet*, 396(10258), 1223–1249. [https://doi.org/10.1016/S0140-6736\(20\)30752-2](https://doi.org/10.1016/S0140-6736(20)30752-2)
- Petticrew, M., Maani Hessari, N., Knai, C., & Weiderpass, E. (2018). The strategies of alcohol industry SAPROS: Inaccurate information, misleading language and the use of confounders to downplay and misrepresent the risk of cancer. *Drug and Alcohol Review*, 37(3), 313–315. <https://doi.org/10.1111/dar.12677>
- Proctor, R. (2011). *Golden holocaust: Origins of the cigarette catastrophe and the case for abolition*. University of California Press.
- Sadeghi, F., Pashaeypoor, S., Nikpajouh, A., & Negarandeh, R. (2024). The impact of healthy nutrition education based on traffic light labels on food selection, preference, and consumption in patients with acute coronary syndrome: A randomized clinical trial. *BMC Public Health*, 24(1), 1332. <https://doi.org/10.1186/s12889-024-18805-2>
- Schuldt, J. P. (2013). Does Green Mean Healthy? Nutrition Label Color Affects Perceptions of Healthfulness. *Health Communication*, 28(8), 814–821. <https://doi.org/10.1080/10410236.2012.725270>
- Song, J., Brown, M. K., Tan, M., MacGregor, G. A., Webster, J., Campbell, N. R. C., Trieu, K., Ni Mhurchu, C., Cobb, L. K., & He, F. J. (2021). Impact of color-coded and warning nutrition labelling schemes: A systematic review and network meta-analysis. *PLOS Medicine*, 18(10), e1003765. <https://doi.org/10.1371/journal.pmed.1003765>
- Stockwell, T., & Hobin, E. (2023). Hidden from View: Alcohol Industry Efforts to Keep the Epidemic of Alcohol-Related Harm from Public Awareness. In N. Maani, M. Petticrew, & S. Galea (Eds.), *The Commercial Determinants of Health* (1st ed., pp. 89–97). Oxford University Press New York. <https://doi.org/10.1093/oso/9780197578742.003.0010>
- US Surgeon General. (2025). *Alcohol and Cancer Risk*. <https://www.hhs.gov/sites/default/files/oash-alcohol-cancer-risk.pdf>
- Weekly low-risk alcohol guidelines*. (n.d.). HSE.Ie. Retrieved February 26, 2026, from <https://www2.hse.ie/living-well/alcohol/health/improve-your-health/weekly-low-risk-alcohol-guidelines/>

- White, L. (1988). *Merchants of death: The American tobacco industry* (1st ed). Beech Tree Books.
- WHO Regional Office for Europe. (2024). *Commercial determinants of noncommunicable diseases in the WHO European Region*.
- Won, S., & Westland, S. (n.d.). Product-specific colour meanings: A semiotic approach. *Journal of the International Colour Association*, 18, 43–59.
- World Health Organization. (2024a). *Global alcohol action plan 2022–30*. <https://www.who.int/publications/i/item/9789240090101>
- World Health Organization. (2024b). *Global status report on alcohol and health and treatment of substance use disorders*.

Research Article

Electronic Portfolios: Experiences of Pre-Registration Nursing Students at the University of Malta

Corinne Scicluna Ward

Department of Nursing, Faculty of Health Sciences, University of Malta, Msida, Malta

Maria Cassar

Department of Nursing, Faculty of Health Sciences, University of Malta, Msida, Malta

Sharon Martinelli

Department of Nursing, Faculty of Health Sciences, University of Malta, Msida, Malta

Daren Chircop

Department of Nursing, Faculty of Health Sciences, University of Malta, Msida, Malta

Barbara Anne Nicolls

Buckinghamshire New University, Wycombe, England, United Kingdom

Abstract

Eportfolios are increasingly used in educational contexts due to their value in meeting employment demands and professional expectations. This paper presents and critically discusses the introduction and evaluation of Google Sites-based eportfolios among students in the Bachelor's nursing programme at the University of Malta in 2020. The eportfolio aimed to nurture systematic assembly of learning experiences and reflections to enhance and document student growth and development. An evaluation exercise explored the benefits and challenges of eportfolios as perceived by pre-registration nursing students. Information was collected from final-year students ($N = 88$) using an online survey in June 2022, at the end of the third year of the Bachelor's programme of studies. Analysis revealed that survey respondents ($N = 29$) engaged with collecting and presenting their learning experiences as evidence of growth and development to varying extents. The use of eportfolios as a vehicle for constructing meaning from

experiences and as a formative assessment tool was limited. A significant gap was identified in reflective critical discussions between students, educators, and qualified nurses regarding students' experiences. Recommendations for similar future initiatives are presented.

Keywords: eportfolio, nurse education, reflective practice, pedagogic tool, University of Malta

1. Introduction

Electronic portfolios (eportfolios) are digital presentations of a student's experiences, achievements, and aspirations that serve as records or evidence of student learning and achievement for specific audiences (Chau & Cheng, 2010; Marinho et al., 2020). Beyond their function as digital dossiers of achievements, similar to traditional presentation or showcase portfolios, eportfolios offer enhanced potential to capture different aspects of learning, making them particularly well-suited for reflection and continuous assessment throughout the learning process (Waland & Shaw, 2022). The Joint Information Systems Committee (2019) recognises eportfolios as essential 21st-century tools for supporting learning, teaching, and assessment.

Eportfolios may help educators redesign educational activities and transform teaching toward more autonomous approaches where learners assume greater

Correspondence to Corinne Scicluna

corinne.scicluna@um.edu.mt

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responsibility in their learning processes (Herbert et al., 2017; Walland & Shaw, 2022). This pedagogical shift addresses growing concerns about traditional, teacher-centred approaches, including suboptimal passive learning outcomes (Cheng et al., 2014; Kweya et al., 2020). Through eportfolios, students can plan learning, showcase individual strengths, monitor progress, and demonstrate performance in alignment with personal goals and respective contexts. Additionally, eportfolios enable reflection upon practice and experience at both personal and professional levels, allowing documentation within a digital context consistent with the contemporary digital age (Chesney & Marcangelo, 2010; Kweya et al., 2020). This approach to demonstrating skills, knowledge, and competencies is gaining prominence across professional and employment contexts, as the focus shifts from academic qualifications and certificates toward the potential to learn, adapt, and perform in dynamic environments.

Using eportfolios in higher education poses challenges, such as the need to train educators and foster cultures amongst all stakeholders that genuinely value eportfolios for recruitment and ongoing development (Castaño Sánchez, 2014). Notwithstanding this, the benefits associated with the use of eportfolios in higher education have outweighed the challenges reported (Lu, 2021), and most recent literature identifies that it is essential for educators and institutions to thoughtfully integrate eportfolios throughout academic programs to capture the full scope of students' educational experiences (Mardonova, 2025; Salam, 2025).

The context-sensitivity of eportfolios is widely recognised (Hsieh, 2025), and whilst all efforts were made to enable favourable outcomes for the initiative, the specific and actual impact of introducing eportfolios at the UM required investigation. Hence, an evaluation survey was developed and administered to students. This paper reports the outcome of an evaluation exercise that sought to explore the perceived impact of eportfolio use on learning amongst nursing students at the University of Malta.

2. Background: Development and Implementation

A designated group of academics within the Department of Nursing at the University of Malta was tasked with reframing an existing learning portfolio used by pre-registration nursing students. The objective was to

transform this static record of achievements into a dynamic learning tool, a 'learning portfolio' that captures student development over time (Butler, 2006; Saeed et al., 2022). The overarching goal of introducing eportfolios was to strengthen learning experiences through expanded student-centered engagement opportunities.

2.1. Stakeholder Alignment and Vision Sharing

Before introducing the eportfolio to students, the designated academic group undertook a comprehensive consultation process to facilitate successful implementation. This process involved two critical phases of stakeholder engagement: First, the vision was shared with all educators and administrators of the undergraduate nursing programme to ascertain that the eportfolios' scope and purpose aligned with the course learning outcomes (Joyes et al., 2010), as illustrated in Figure 1. Second, consultation was extended to all relevant stakeholders (Figure 2) to legitimise the eportfolios' place within the learning process across educational, regulatory, and employment contexts (Lewis, 2017).

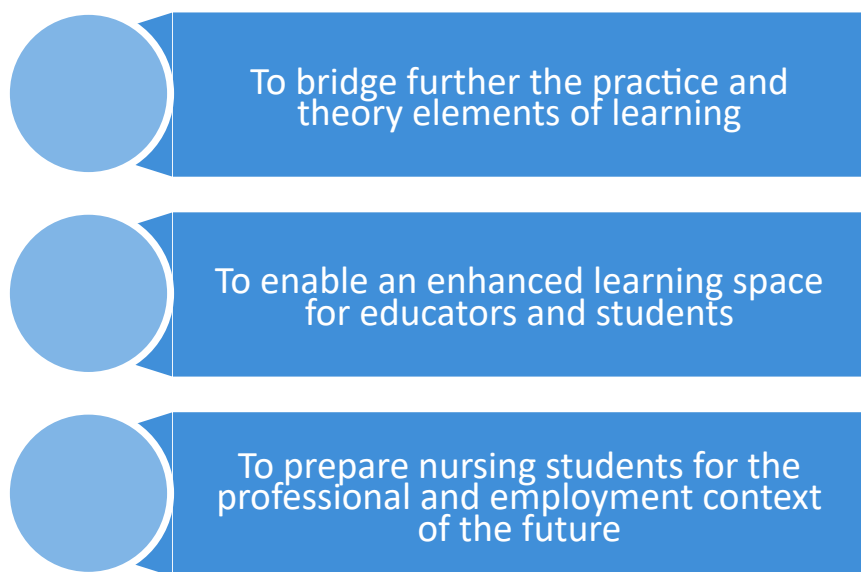


Figure 1. The Vision

This initial consultation phase revealed the critical importance of building educators' confidence in and support for the eportfolio as a learning tool before inviting student participation. Recognising this foundational requirement, a structured approach was implemented through three key initiatives:

Comprehensive Educator Training: Multiple sessions were organised to provide educators with comprehensive information on eportfolio functions. These sessions explained the process of providing students with robust support while ensuring the seamless integration of learning experiences into their eportfolios.



Figure 2. Stakeholders

Eportfolio Champions Programme: Two full-time academic staff members were appointed as "Eportfolio Champions," acting as the principal contacts for students, educators, and stakeholders on all eportfolio-related matters and inquiries. Both individuals accepted the role following an open invitation sent to all academic staff, indicating their interest and commitment to the position.

External Expert Consultation: An external expert consultant with extensive experience in establishing eportfolio use in higher education settings was contracted to:

- Direct the eportfolio champions in design and implementation strategies
- Oversee the production of a digital user survival guidebook as an accessible resource for both students and educators at the Department of Nursing

2.2. Student Implementation and Ongoing Support

Following these preparatory measures, a series of training sessions were delivered to nursing students and educators. At the same time, optional one-to-one and group support remained available for educators while they adopted this novel educational technology. The introduction of eportfolios in the pre-registration programme in nursing studies at the University of Malta (UM) was innovative because it was the first time students used digital portfolios. These eportfolios functioned as real-time learning tools. They enabled students to comprehensively document their learning experiences, engage in guided reflection, and actively interact with educators. Portfolios had been previously used to primarily document and record students' intended and observed learning in the practice settings organised by the UM. The digital interface, longevity, and comprehensive, eclectic nature of e-portfolios represent a novel advancement in the long-standing good practice of student portfolios at the Department of Nursing at the University of Malta.

3. Methods

The evaluation exercise reported in this paper adopted a descriptive, exploratory approach, with information collected via an online survey tool. Specifically, final-year nursing students (N = 88) enrolled in the University of Malta's three-year undergraduate pre-registration

Bachelor's degree programme in June 2022 were invited to complete the online survey. A descriptive analysis of the data collected through the survey was conducted. The questions in the Google Survey Form (GSF) were designed to explore nursing students' perspectives, as end users, on the impact of the eportfolio on their learning.

3.1. Information Collection Procedure

Two complementary information gathering strategies were employed to maximise participation opportunities. Initially, the entire final-year cohort received an invitation to complete the online survey through the University of Malta's e-learning platform, which included a direct link to the GSF. Subsequently, to facilitate access for students who may have encountered technical barriers, laptops were made available in a designated area within the Faculty of Health Sciences over three consecutive days during specified hours, allowing students to complete the survey voluntarily at their convenience.

3.2. Response Rate

A total of 29 students completed the GSF, representing a 33% response rate. Whilst this limited response rate restricts the generalisability of the findings, the data collected nonetheless provided valuable insights into students' perceptions of eportfolio use. The inclusion of open-ended questions enabled graduating students to reflect comprehensively on their experiences with the eportfolio system.

3.3. Survey

The GSF employed a mixed-methods approach incorporating three distinct question types. Initial closed questions assessed the extent of student engagement with the eportfolio platform. Subsequently, students completed self-assessment questions evaluating their eportfolio development status using a traffic light system: Red indicated "significant issues that need to be addressed"; Amber signified "problems that may be easily addressed with project facilitator or project delivery team support"; and Green represented that "all aspects of eportfolio development are on track." The survey concluded with open-ended questions designed to capture individual student experiences with eportfolio compilation. The complete survey instrument is presented in Table 1.

Table 1: Survey Instrument for Google Sites eportfolio Development

Q#	Survey Item	Response Type
1	How long have you been developing your Google Sites eportfolio for?	Multiple choice (duration options)
2	How often do you engage with your Google Sites eportfolio?	Multiple choice (frequency options)
3	Using the traffic light system, how would you rate the status of your Google Sites eportfolio development?	Multiple choice (Red/Amber/Green)
4	If your answer is either Red or Amber, what are your next steps to transform it to Green?	Open-ended text
5	What do you perceive as the positive aspects of developing your eportfolio? List 3 things.	Open-ended text
6	What do you perceive as the negative aspects of developing your Google Sites eportfolio? List 3 things.	Open-ended text
7	What do you suggest that the course team do to improve the negative aspects?	Open-ended text

(Note. Survey items developed by the researchers for the study)

3.4. Information Analysis

To minimise insider bias, four academics from the Department of Nursing collaboratively analysed the survey responses. Quantitative responses from the first three questions were analysed using Excel (Table 2).

The qualitative information from open-ended questions underwent systematic thematic analysis following established procedures. The analysis process involved three sequential stages: (1) multiple readings of all responses to achieve familiarisation with the content; (2) identification and listing of recurring keywords and phrases, such as references to eportfolios being "useful," "organised," or "accessible"; and (3) grouping these codes under broader thematic categories.

The resulting themes are presented in Tables 3 and 4, each accompanied by explanatory descriptions and supporting direct quotations from student responses. This systematic approach ensured comprehensive representation of the evaluation outcomes while maintaining analytical rigour.

4. Ethical Considerations

Institutional ethical clearance was not required because the evaluation reported in this paper was conducted as an educational exercise specifically designed to monitor

and improve the implementation of a new pedagogical tool within the Department of Nursing. The exercise focused exclusively on collecting anonymous student perspectives to inform the internal development of the tool, rather than on generating research data. Nevertheless, drawing upon the principles of the University of Malta Research Code of Practice and the Research Ethics Review Procedures, ethical safeguards included voluntary participation, implied informed consent through completion of an anonymous survey, secure handling of student responses, and the absence of academic staff while students completed the evaluation survey. In addition, the subsequent dissemination of students' responses was conducted in line with best-practice guidance (Committee on Publication Ethics, 2019), ensuring ethical standards were maintained throughout.

The authors acknowledge a potential limitation: the evaluation was conducted by the same individuals who designed and implemented the eportfolio initiative. To mitigate concerns about evaluation rigour and maintain objectivity, extensive verbatim excerpts from student responses are presented throughout the findings to remain faithful to respondents' authentic perspectives and minimise the researchers' bias in interpretation.

5. Findings

Analysis of responses from 29 respondents to the initial three survey questions revealed key characteristics of eportfolio engagement patterns (Table 2). The majority (N = 10) of respondents had been developing their eportfolio for six semesters, indicating sustained long-term engagement with the platform. Monthly engagement emerged as the most prevalent pattern among respondents

(N = 12), suggesting regular but not intensive interaction with the eportfolio system. Regarding self-assessed proficiency, nine respondents rated their eportfolio development skills as "Green," indicating competent technical capability. Complete response distributions for these three foundational questions are presented in Table 2, providing comprehensive baseline data for subsequent analysis.

Table 2: Analysis of the first 3 questions of the Survey

1. How long have you been developing your Google Sites eportfolio for?	
Response	Count
1 semester	0
2 semesters	5
3 semesters	4
4 semesters	7
5 semesters	0
6 semesters	10
Other	3
	29
2. How often do you engage with your Google Sites eportfolio?	
Response	Count
Weekly	1
Fortnightly	1
Monthly	12
Never	10
Other	5
	29

Table 2: Analysis of the first 3 questions of the Survey

3. Using the traffic light system, how would you rate the status of your Google Sites eportfolio development?	
Response	Count
Green (All aspects of the eportfolio development are on track so far)	9
Amber (A problem has a negative effect on my performance, but can be dealt with by the project manager or project delivery team.	12
Red (There are significant issues that I need to address)	8
	29

5.1. Perceptions of the Eportfolio Experience

Analysis of responses to open-ended questions revealed that students identified multiple perceived benefits of engaging with the eportfolio platform. Respondents valued the opportunity to organise personal and academic information in a structured and secure digital environment, enabling them to maintain comprehensive records of their educational journey. The platform's capacity to provide authorised access to collated achievements was particularly appreciated, as

it facilitated seamless sharing of accomplishments with identified stakeholders. Students also recognised the eportfolios' function as a valuable tool for self-assessment and professional development, supporting the visibility of their learning processes and enabling systematic tracking of progress over time. This reflective capability helped respondents identify specific areas requiring improvement and fostered greater awareness of their educational growth. Illustrative excerpts from student responses to these open-ended questions are presented in Tables 3 and 4.

Table 3: Positive Perceptions of the eportfolio experience

Theme	Meaning of the Theme	Excerpts from the Data
Opportunity to organise safely the information about oneself	Respondents shared that the eportfolio provided them with a unique opportunity to organise information in a structured manner, guided by the requisites of the initiative and reviewed by the Link Lecturers.	"Data cannot be lost, easily accessible, lasts a lifetime" (R2)
		"Everything is well organised" (R9)
		"Documents can be easily filed chronologically" (R11)
		"It is environmentally friendly, since a lot of paperwork and documents can be scanned online." (R22)

Table 3: Positive Perceptions of the eportfolio experience

Theme	Meaning of the Theme	Excerpts from the Data
Easily accessible to anyone who is authorised to access it	Respondents recognised and appreciated the value of having one's learning and achievements collated in one resource, to which the student may authorise access at their discretion.	"Documents can be easily shared with others" (R12) "Makes learning visible/showcase learners' achievements when applying for a job/ establish clear expectations" (R18)
An opportunity for self-assessment and self-development	Respondents recognised that the eportfolio facilitated self-assessment and contributed to personal development.	"That I get to see my progress over the years" (R11) "That I could identify the aspects that I need to work on to better myself" (R17) "Self-development, understanding what we are lacking, and a way to show future employees what we have learned" (R24)

Note. "R" indicates respondent.

However, the analysis also revealed significant challenges that students experienced in maintaining their eportfolios, which created substantial barriers to sustained engagement with the platform. These challenges encompassed several interconnected dimensions. Many respondents reported experiencing stress and feelings of being overwhelmed by the eportfolio requirements, often stemming from uncertainty about expectations and technical demands. A prevalent concern centered on students' belief that the eportfolio lacked institutional recognition and was perceived as unnecessary within their academic program, leading to reduced motivation for engagement. Time management emerged as another critical barrier, with respondents expressing concerns

about the substantial time commitment required for effective eportfolio maintenance amid competing academic demands. Technical challenges further compounded these difficulties, as students encountered various technological obstacles that impeded their ability to effectively utilise the platform. Finally, respondents identified a fundamental lack of clarity regarding the eportfolios' purpose and specific expectations for content and development, which created confusion and hindered meaningful engagement. These multifaceted challenges collectively translated into significant barriers that prevented students from achieving optimal engagement with the eportfolio system.

Table 4: Negative Perceptions of the eportfolio experience

Theme	Meaning of the Theme	Excerpts from the Data
Stressful and Overwhelming	They considered it time wasting, stress inducing and a hassle.	"Stressful, hassle, takes up too much time." (P 2) "...cause of anxiety and added stress to an already stressful course." (P 24)
Not Recognised and Not Needed	Participants felt they did not gain anything for their eportfolio.	"We were never asked for our eportfolio..." (P 8) "...a total waste. It is completely unnecessary for our job." (P 4)

Table 4: Negative Perceptions of the eportfolio experience

Theme	Meaning of the Theme	Excerpts from the Data
Time-Consuming	Found it took a lot of time to compile.	"... was a burden and I considered this as extra work." (P 8)
Technological Difficulty	The dependence on technology, plus the need to continue using paper-based processes, made the system impractical and time-consuming.	"People who are not very keen on technology may find it a bit difficult." (P 14) "...difficulties to develop the eportfolio via Google Sites." (P 18)
Lack of Clarity	Objectives were not clear.	"...unclear objective as to where we will use it, aims of such development are unclear." (P 15) "... not even my link lecturer could care that I needed signatures for it." (P 4)

6. Discussion

The implementation of eportfolios in health professions education has gained considerable momentum across recent decades, with documented use in midwifery, medicine, nursing, and pharmacy programmes (Lopez et al., 2011; Saeed et al., 2020; Vernazza et al., 2011). Eportfolio-based learning encompasses the transformative processes of planning, synthesising, sharing, discussing, reflecting, and engaging with feedback about experiences presented through digital media (Green et al., 2014). This comprehensive approach positions eportfolios as effective digital pedagogical tools that actively facilitate learning through multiple interconnected processes (Bass, 2014; Eynon & Gambino, 2014; Saeed et al., 2020; Scully et al., 2018).

The pedagogical value of eportfolios is supported by a growing evidence base demonstrating their effectiveness in promoting self-directed learning, self-assessment, integrated thinking, and reflective practice (Crichton & Kopp, 2009; De Bruin & Van der Schaaf, 2012; Haig, 2013; Nicolls, 2019; Nicolls et al., 2017; Reeves, 2000). These capabilities align with contemporary educational approaches that emphasise learner autonomy and critical reflection as essential components of professional development in healthcare settings.

The current evaluation's findings present a distinctive picture of student experiences with eportfolio implementation. Students recognised the practical utility of eportfolios as repositories for storing and

accessing documents, forms, assignments, reflective accounts, and artifacts of learning experiences. However, this positive recognition was tempered by significant challenges. Some students perceived the eportfolio as offering minimal value, describing it as unproductive and a poor use of their limited time. Navigation difficulties compounded these concerns, with students reporting substantial challenges in effectively utilising the eportfolio system throughout their programme duration, particularly when balanced against other academic demands.

These mixed findings are consistent with the broader literature on eportfolio implementation in higher education contexts. Previous studies have similarly documented a spectrum of student experiences, ranging from enthusiastic engagement to significant implementation challenges (Andrews & Cole, 2015; Heath, 2005; Janssens et al., 2022; Strudler & Wetzel, 2005). This pattern suggests that while eportfolios possess considerable pedagogical potential, their successful implementation requires careful attention to system design, user training, and integration with existing programme structures to maximise student engagement and minimise perceived burden.

The survey responses suggest that several fundamental assumptions about student readiness may have been overestimated. Students' capacity for reflective learning, self-directed learning, and autonomous learning plan development appeared more limited than anticipated. Similarly, their ability to collate and present evidence

demonstrating participation and learning achievements proved constrained. Students demonstrated uncertainty in identifying and integrating learning opportunities and resources, which impeded their ability to establish meaningful connections between the eportfolio and their broader educational journey. This challenge was compounded by inconsistent educator engagement with student eportfolios, which further diminished the perceived value of the platform as both a learning record and progress measurement tool.

These findings highlight critical areas requiring attention in future eportfolio implementations. The preparedness of nursing students in Malta for self-directed and student-led learning approaches warrants further investigation, particularly regarding the integration of learning across digital platforms. Greater investment in developing students' capacity to take responsibility for their own professional development appears essential for similar student-centred initiatives to succeed. Additionally, the development of effective reflection skills requires more prominent attention within nursing curriculum content and delivery methods.

As Janssens et al. (2022) emphasise, eportfolios do not inherently teach students how to reflect effectively. While these platforms can facilitate experiential learning and critical thinking, their effectiveness depends fundamentally on students' existing understanding of reflection principles and methodologies. Without this foundational knowledge, students cannot fully realise the learning benefits that eportfolios offer. Recognising this critical gap, the Department of Nursing has subsequently implemented multiple measures to enhance students' reflective capabilities and optimise their engagement with experiential learning practices.

The limited value attributed to eportfolios by some students may stem from two interconnected factors. First, students reported insufficient recognition or acknowledgement from educators for their compilation efforts, which potentially undermined their motivation to engage meaningfully with the platform. Second, the disconnect between academic requirements and professional practice became apparent when students recognised that local nurse recruitment processes within public services do not require eportfolio submission, while promotion processes have only recently adopted portfolio presentation as a selection criterion. The Department may have underestimated how this misalignment between academic expectations and

immediate employment realities would impact student motivation and compliance.

These findings suggest that the Department's mission to prepare students for continuous self-directed professional development, aligned with predicted future workforce demands and international employment requirements (Pegrum & Oakley, 2017), did not sufficiently motivate students to engage with portfolio compilation. The evaluation reveals a potential paradigmatic conflict between educators' social constructivist teaching approach, which encourages students to actively construct their own knowledge, and students' apparent preference for a more behaviourist learning model, characterised by passive reception of transmitted knowledge. This paradigmatic dissonance warrants further investigation.

Future evaluation should examine eportfolio implementation from educators' perspectives, exploring their experiences, challenges, and support needs. Additionally, a critical examination of how digital technologies like eportfolios can be more effectively integrated within programme curricula is essential. Conversations with educators regarding optimal eportfolio design, implementation processes, and the development of constructive feedback skills are particularly important for successful adoption.

The evidence base for eportfolio effectiveness remains limited. Janssens et al.'s (2022) systematic review identified that existing studies have primarily focused on evaluating user and stakeholder perceptions rather than measuring actual impact on learning outcomes and student learning experiences. This represents a significant gap in understanding the true educational value of eportfolios. Furthermore, the literature indicates that engagement challenges are complex and multifaceted, with successful implementation requiring more than simple awareness of eportfolio value; it demands comprehensive support structures and pedagogical alignment (Janssens et al., 2022).

Student responses highlighted significant technology-related barriers, including difficulties with navigation and confident usage of digital platforms. These technological limitations are not unique to nursing students in Malta but represent a broader challenge in higher education. While eportfolios offer advantages over traditional portfolios through integration with electronic media, social networking sites, and simulation resources, potentially stimulating self-development and

facilitating electronic evidence compilation, students require enhanced technological confidence to fully exploit these capabilities.

7. Implications for Future Evaluation and Practice

The findings highlight the need for a comprehensive evaluation examining both intrinsic and extrinsic factors influencing student and educator engagement with eportfolios. Qualitative and mixed-methods approaches could provide deeper insights into how personal, contextual, and institutional dynamics impact eportfolio utilisation. The interplay between learner motivation and educator support warrants particular attention (Lee et al., 2023; Smith & Jones, 2022). Longitudinal evaluation tracking engagement patterns over time would identify critical intervention points where educator support might prove most effective, while intervention studies testing targeted support strategies could establish evidence-based best practices for fostering sustained use and meaningful learning outcomes.

Several practical recommendations emerge from this evaluation. First, developing structured orientation programmes and continuous support mechanisms could clarify expectations and reduce implementation barriers. Second, comprehensive professional development initiatives for educators are essential to promote their understanding, endorsement, and active engagement with eportfolio processes. Third, improving platform usability and integration with existing learning management systems would reduce technological challenges and perceived workload. Finally, embedding reflective practice skills more explicitly within programme curricula would reinforce the eportfolio's relevance and educational value.

The multifaceted nature of successful eportfolio implementation cannot be overstated. This evaluation experience with nursing students at the University of Malta demonstrates that effective adoption requires coordinated attention to technological, pedagogical, and institutional factors. Future implementations must address these interconnected elements systematically to maximise eportfolios' potential as tools for learning and professional development.

7.1. Emerging Considerations: Artificial Intelligence Integration

An important contextual note concerns the timing of this eportfolio introduction, which occurred when public access to generative artificial intelligence tools was limited. Contemporary nursing students now have access to AI technologies such as ChatGPT and Google Gemini, which could support eportfolio development by providing guidance on structure, content identification, and evidence presentation. Structured prompts and targeted tutorials could help students engage meaningfully and ethically with these tools for self-reflection, goal-setting, content organisation, and design enhancement. Whether AI integration facilitates deeper eportfolio engagement represents an important area for future investigation. To-date, the evidence in this regard is meagre (Sankey, 2025).

7.2. Platform Selection and Technical Considerations

The selection of Google Sites as the eportfolio platform was an evidence-informed decision, supported by available studies demonstrating its educational efficiency (Ng & Hussain, 2013). While Google Sites continues to receive advocacy for educational applications (Anh & Truong, 2023), the platform presents notable limitations, including restricted design customisation options and limited built-in tools for learner assessment and progress monitoring. These constraints suggest that alternative platforms may offer superior functionality for eportfolio design, presentation, sharing, and storage requirements. Future implementations should therefore evaluate emerging platforms that may better support comprehensive eportfolio functionality and user experience.

7.3. Assessment Integration and Sustainability

A critical factor influencing engagement emerged around formal assessment structures. The allocation of marks to eportfolio tasks appears to enhance meaningful engagement from both students and educators. To improve educational value and long-term sustainability, future eportfolio initiatives should consider formal curriculum integration as assessed programme components. Assessment frameworks provide necessary structure, ensure consistent expectations, and reinforce

the importance of reflective learning within professional development contexts. The impact of integrating eportfolios into formal assessment processes represents a vital area for future evaluation.

7.4. Ongoing Development and Adaptation

While this initial evaluation yielded encouraging results, the findings indicated the need for ongoing modifications. The Department of Nursing has subsequently implemented changes based on these evaluation outcomes, alongside insights from periodic programme reviews and evolving organisational requirements. This iterative approach to eportfolio development demonstrates the importance of continuous evaluation and adaptation to optimise educational effectiveness and institutional fit.

8. Limitations

This evaluation presents several important limitations that must be acknowledged. The primary limitation concerns the response rate: only 29 of 88 targeted final-year pre-registration nursing students (33%) completed the survey. This significantly constrains the representativeness of findings and limits their generalisability, requiring cautious interpretation of results. The small sample size compounds this concern, particularly given that data were based on subjective student opinions rather than objective educational outcome measures (Crane & French, 2021).

A methodological limitation involves the dual role of educators who both designed the eportfolio initiative and conducted the evaluation. While efforts were made to maintain objectivity through verbatim reporting of student responses, this arrangement introduces potential bias that should be addressed in future evaluations through independent evaluation teams.

Contextual factors also require consideration. The eportfolio was introduced before the COVID-19 pandemic, during a period of increasing institutional commitment to digital learning tools. This timing may have positively influenced initial uptake and perceived value among students and staff, potentially affecting the generalisability of findings to other temporal contexts. The six-year implementation period since introduction demonstrates that sustaining such initiatives presents ongoing challenges that must be considered when interpreting outcomes and their broader applicability.

9. Future Evaluation Directions

Future evaluation should adopt comprehensive approaches to understanding eportfolio implementation in nursing education. Priority areas include examining both intrinsic and extrinsic factors influencing student and educator engagement, with particular attention to motivational and contextual dimensions. Qualitative and mixed-methods approaches would be particularly valuable in capturing the complexity of these dynamics and providing deeper insights into user experiences.

Longitudinal evaluation of engagement patterns across multiple semesters is essential to understanding how attitudes and usage evolve over time and to identify optimal intervention points. Additionally, evaluation should extend beyond student perspectives to explore educator experiences, challenges, and support needs for effective eportfolio facilitation.

Investigation of the integration of formal assessment represents another critical evaluation priority. Studies examining the impact of embedding eportfolios within assessment frameworks could provide evidence for optimal implementation strategies that enhance both engagement and learning outcomes.

10. Recommendations for Practice

Several practical measures emerge from this evaluation to strengthen eportfolio adoption and effectiveness. First, comprehensive orientation programmes and ongoing support mechanisms should be established to clarify expectations and reduce implementation barriers for both students and educators. Professional development opportunities for academic staff are essential to ensure consistent advocacy and effective integration within curricula.

Technical improvements focusing on platform usability and integration with existing learning management systems could significantly reduce perceived workload and technological barriers. Additionally, embedding reflective practice more explicitly into teaching and assessment activities would reinforce the value and relevance of eportfolios.

Given contemporary developments in artificial intelligence, structured guidance for ethical and effective use of AI tools in eportfolio development represents an emerging priority. Targeted tutorials and prompts could help students use these technologies for reflection, organization, goal-setting, and design enhancement.

11. Conclusion

This evaluation examined final-year nursing students' experiences with eportfolios at the University of Malta, revealing both perceived benefits and significant implementation challenges. While students recognised eportfolios as useful tools for organising learning artifacts and monitoring development, responses indicated limited improvement in learning outcomes or deeper reflective practice. Student uncertainty about purpose and relevance was compounded by the absence of formal assessment components and limited employment relevance post-graduation.

The findings highlight that successful eportfolio integration requires comprehensive embedding within programme teaching and learning strategies, supported by extensive training for both educators and students. Most critically, eportfolio implementation must align with programme-level learning outcomes emphasising reflective and independent learning from the outset.

This evaluation contributes valuable insights to an underexplored area of nursing education practice. The experience demonstrates that continued evaluation, strategic investment, and sustained institutional support are essential for maintaining eportfolio relevance, functionality, and educational impact over time. These findings inform local refinement efforts while providing guidance for similar initiatives in other educational contexts.

12. Funding and Conflicts of Interest

No external funding was received for this evaluation. Institutional funds supported the contracted external expert services for one year. The authors acknowledge that the same educators involved in eportfolio design and implementation conducted this evaluation exercise. Every effort was made to maintain objectivity during analysis, including verbatim reporting of student responses to accurately represent respondent perspectives.

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References

- Andrews, T., & Cole, C. (2015). Two steps forward, one step back: The intricacies of engaging with e-portfolios in nursing undergraduate education. *Nurse Education Today*, 35(4), 568–572. <https://doi.org/10.1016/j.nedt.2014.12.011>
- Anh, T. T. N., & Truong, N. N. (2023). Mobile E-Portfolios on Google Sites: A tool for enhancing project-based learning. *International Journal of Interactive Mobile Technologies*, 17(11).
- Anthropic. (2025). Claude [Large language model]. <https://claude.ai>
- Bass, R. (2014). *Social pedagogies in eportfolio practices: Principles for design and impact*. Catalyst for Learning. www.c2l.mcnrc.org
- Butler, P. (2006). *A review of the literature on portfolios and electronic portfolios*. <https://eduforge.org/docman/view.php/176/1111/eportfolio%20Project%20Research%20Report.pdf>
- Castaño Sánchez, A. X. (2014). The Application of Eportfolio in Higher Education: implications for Student Learning. *UTE Teaching & Technology (Universitas Tarraconensis)*, 1(2), 99–103. <https://revistes.urv.cat/index.php/ute/article/view/462>
- Chau, J., & Cheng, G. (2010). Towards understanding the potential of eportfolios for independent learning: A qualitative study. *Australasian Journal of Educational Technology*, 26(7), 932–950.
- Cheng, G., Chau, J., & Tang, C. (2014). Exploring the relationships between learning styles, online participation, learning achievement and course satisfaction: An empirical study of a blended learning course. *British Journal of Educational Technology*, 47(2), 257–278.
- Chesney, S., & Marcangelo, C. (2010). 'There was a lot of learning going on' Using a digital medium to support learning in a professional course for new HE lecturers. *Computers & Education*, 54(3), 701–708. <https://doi.org/10.1016/j.compedu.2009.09.027>
- Committee on Publication Ethics. (2019). *Principles of transparency and best practice in scholarly publishing*. <https://publicationethics.org/resources/guidelines>

- Crane, T., & French, C. (2021). The problem of perception. In E. N. Zalta (Ed.), *The Stanford encyclopedia of philosophy* (Fall 2021 ed.). <https://plato.stanford.edu/archives/fall2021/entries/perception-problem/>
- Crichton, S., & Kopp, G. (2009). The value of eJournals to support eportfolio development for assessment in teacher education. *Canadian Journal of Learning and Technology*, 34(3). <https://doi.org/10.21432/t2ts3h>
- De Bruin, H., & Van der Schaaf, M. (2012). Effects of portfolio assessment on students' motivation, learning strategies, and academic outcomes: A quasi-experimental design. *Assessment & Evaluation in Higher Education*, 37(1), 11–30.
- Eynon, B., & Gambino, L. M. (2014). What difference can eportfolio make? A field report from the Connect to Learning Project. *International Journal of eportfolio*, 4(1), 95–114.
- Green, J., Wyllie, A., & Jackson, D. (2014). Electronic portfolios in nursing education: A review of the literature. *Nurse Education in Practice*, 14(1), 4–8. <https://doi.org/10.1016/j.nepr.2013.08.011>
- Haig, D. A. J. (2013). *The effectiveness of self-assessment and its viability in the electronic medium* [Doctoral dissertation, University of Dundee].
- Heath, M. (2005). Are you ready to go digital?: The pros and cons of electronic portfolio development. *Library Media Connection*, 23(7), 66–70.
- Herbert, L., Bain, J., & Dalgarno, B. (2017). How large-scale implementation of iPads in a teacher education program facilitated the development of personal learning networks. *Computers & Education*, 114, 111–121.
- Hsieh, Y.-J. T. (2025). *Implementation of an ePortfolio to promote professional pathways: A case study of international students in Australian higher education*. *Journal of University Teaching and Learning Practice*, 22(3). <https://doi.org/10.53761/>
- Janssens, O., Haerens, L., Valcke, M., Beeckman, D., Pype, P., & Embo, M. (2022). The role of eportfolios in supporting learning in eight healthcare disciplines: A scoping review. *Nurse Education in Practice*, 63. <https://doi.org/10.1016/j.nepr.2022.103418>
- Joint Information Systems Committee. (2019). *How to enhance student learning, progression and employability with e-portfolios*. JISC.
- Joyes, G., Gray, L., & Hartnell-Young, E. A. (2010). Effective practice with e-portfolios: How can the UK experience inform implementation? *Australasian Journal of Educational Technology*, 26(1), 15–27. <https://doi.org/10.14742/ajet.1099>
- Kweya, S., Flesher, J., & Klein, S. (2020). Using Google Sites to build eportfolios in teacher education: Addressing CAEP accreditation. *TechTrends*, 64, 615–625.
- Lee, S., Kim, J., & Park, H. (2023). Student motivation and educator engagement in digital portfolio implementation. *Educational Technology Research*, 45(2), 123–140.
- Lewis, L. (2017). eportfolio as pedagogy: Threshold concepts for curriculum design. *E-learning and Digital Media*, 14(1–2), 72–85. <https://doi.org/10.1177/2042753017694497>
- Lopez, T. C., Trang, D. D., Farrell, N. C., De Leon, M. A., Villarreal, C. C., & Maize, D. F. (2011). Development and implementation of a curricular-wide electronic portfolio system in a school of pharmacy. *The American Journal of Pharmaceutical Education*, 75(5), 89. <https://doi.org/10.5688/ajpe75589>
- Lu, H. (2021). Electronic portfolios in higher education: A review of the literature. *European Journal of Education and Pedagogy*, 2(3), 96–101.
- Mardonova, G. (2025). DIGITAL PORTFOLIOS AS AN ALTERNATIVE TO TRADITIONAL ASSESSMENTS. *International Journal of Artificial Intelligence*, 1(3), 1375–1381.
- Marinho, P., Fernandes, P., & Pimentel, F. (2020). The digital portfolio as an assessment strategy for learning in higher education. *Distance Education*, 42(2), 253–267.
- Ng, H. Z., & Hussain, R. M. R. (2013, October). The use of Google sites as a formative assessment tool (eportfolio) in higher education. In *2013 IEEE 63rd Annual Conference International Council for Education Media (ICEM)* (pp. 1–9). IEEE.
- Nicolls, B. (2019). *How to enhance student learning, progression and employability with e-portfolios case studies and guidance on e-portfolios for UK further and higher education*. <https://www.jisc.ac.uk/guides/e-portfolios>
- Nicolls, B., Roadnight, S., & Clarke, D. (2017). Fostering self-assessment by scaffolding in the operating department practice eportfolio. *AAEEBL eportfolio Review: Assessment Practices*, 1(3), 8–26.
- Pegrum, M., & Oakley, G. (2017). The changing landscape of e-portfolios: Reflections on 5 years of implementing e-portfolios in pre-service teacher education. In *E-portfolios in higher education: A multidisciplinary approach* (pp. 21–34). Springer Singapore.

- Reeves, T. C. (2000). Alternative assessment approaches for online learning environments in higher education. *Journal of Educational Computing Research*, 23(1), 101–111. <https://doi.org/10.2190/gymq-78fa-wmtx-jo6c>
- Saeed, M. A., Babar, M. G., Chaudhry, B. M., Ashraf, M., & Ahmad, M. (2022). Learning portfolios: An educational tool to promote reflective learning among undergraduate medical students. *BMC Medical Education*, 22, 1–8.
- Saeed, M. A., Coleman, K., Jabbar, A., & Krekeler, N. (2020). Electronic portfolios for learning and teaching in veterinary education. *The AAEEBL eportfolio Review*, 4(1), 28–42.
- Salam, M. A. (2025). The student e-portfolios: Importance and relevance at higher learning institutions. *Taj: Journal of Teachers Association*, 38(2), 1–4.
- Sankey, M. (2025). ePortfolio traditions that are ready to be broken and new ones ready to be established. *Journal of University Teaching and Learning Practice*, 22(3), 1–14.
- Scully, D., O'Leary, M., & Brown, M. (2018). *The learning portfolio in higher education: A game of snakes and ladders*. Dublin City University, Centre for Assessment Research, Policy & Practice in Education (CARPE) and National Institute for Digital Learning (NIDL). <https://doi.org/10.13140/RG.2.2.18883.71208>
- Smith, A., & Jones, B. (2022). Digital learning environments and student engagement patterns. *Educational Technology Review*, 38(4), 45–62.
- Strudler, N., & Wetzel, K. (2005). The diffusion of electronic portfolios in teacher education. *Journal of Research on Technology in Education*, 37(4), 411–433. <https://doi.org/10.1080/15391523.2005.10782446>
- University of Malta. (n.d.). *Research code of practice and research ethics review procedures*. <https://www.um.edu.mt/research/code-of-practice>
- Vernazza, C. R., Durham, J., Ellis, J. S., Teasdale, D., Cotterill, S., Scott, L., Thomason, M., Drummond, P. D., & Moss, J. H. (2011). Introduction of an e-portfolio in clinical dentistry: Staff and student views. *European Journal of Dental Education*, 15(1), 36–41.
- Walland, E., & Shaw, S. (2022). E-portfolios in teaching, learning and assessment: Tensions in theory and praxis. *Technology, Pedagogy and Education*, 31(3), 363–379. <https://doi.org/10.1080/1475939X.2022.2074087>