Vilnius University Press

Contents lists available at Vilnius University Press

Acta Paedagogica Vilnensia
2026, vol. 56, pp. 228–248

ISSN 1392-5016 eISSN 1648-665X
DOI: https://doi.org/10.15388/ActPaed.2026.56.13

Learning Beyond the Lesson: Lifelong Learning Tendencies and Strategic Learning in Violin Education

Şenol Afacan
Kırşehir Ahi Evran University, Turkey
safacan@ahievran.edu.tr
https://orcid.org/0000-0001-7564-1695
https://ror.org/05rrfpt58

Abstract. This quantitative correlational study examines how lifelong learning tendencies relate to strategic learning behaviors among undergraduate violin students in Turkish higher music education. Forty participants from two universities completed validated instruments assessing lifelong learning dispositions and violin-specific learning strategies. The results indicate that students demonstrated high motivation and persistence alongside minimal deficiencies in learning regulation and curiosity. They reported frequent use of cognitive and metacognitive strategies – particularly, organization, monitoring, and rehearsal – and moderate use of elaboration and affective strategies. Motivation and persistence were strongly associated with strategic behaviors, especially organizational and monitoring processes, underscoring the interdependence of dispositional and self-regulatory dimensions in instrumental learning within the feedback-intensive and self-regulated context of violin practice. No significant differences were observed between universities or grade levels, thereby reflecting consistent pedagogical approaches across institutions. Theoretically, the findings extend self-regulated and lifelong learning models to the domain of music education, illustrating how motivational and regulatory constructs interact within instrumental pedagogy. Practically, integrating structured self-regulation activities and guided reflection into violin instruction may enhance both artistic performance and the development of sustainable lifelong learning capacities among future educators and performers.
Keywords: Music education; violin pedagogy; instrumental practice; learning strategies; lifelong learning; higher education; self-directed learning.

Mokymasis po mokyklos: visą gyvenimą trunkančio mokymosi tendencijos ir strateginis mokymasis smuikininkų ugdymo procese

Santrauka. Šiame kiekybiniame koreliaciniame tyrime analizuojama, kaip Turkijos aukštosios muzikos mokyklos smuiko bakalauro studijų studentų visą gyvenimą trunkančio mokymosi tendencijos susijusios su strateginio mokymosi elgsena. 40 dalyvių iš dviejų universitetų užpildė validuotus klausimynus, vertinančius polinkį į visą gyvenimą trunkantį mokymąsi ir smuikininkų naudojamas mokymosi strategijas. Tyrimo nustatyta, kad studentai pasižymi didele motyvacija ir atkaklumu, o mokymosi reguliavimo ir smalsumo įverčiai buvo ne tokie aukšti. Dalyviai nurodė dažnai taikantys kognityvines ir metakognityvines strategijas, ypač organizavimą, stebėjimą ir repeticijas, bei vidutiniškai dažnai – detalizavimo ir afektines strategijas. Motyvacija ir atkaklumas stipriai koreliuoja su strateginiu elgesiu ir ypač su organizavimo bei stebėjimo procesais. Visa tai rodo tam tikrų bruožų ir savireguliacijos priklausomybę instrumentinio mokymosi smuikuojant procese, kuriam būdingas aktyvus grįžtamasis ryšys ir savireguliacija. Tyrimas neatskleidė reikšmingų skirtumų tarp skirtingų universitetų ar kursų studentų, ir tai rodo, jog visose

Received: 16/03/2025. **Accepted:** 21/04/2026
Copyright © Şenol Afacan, 2026. Published by Vilnius University Press. This is an Open Access article distributed under the terms of the Creative Commons Attribution Licence (CC BY), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

institucijose naudojami nuoseklūs pedagoginiai metodai. Teoriniu lygmeniu šie rezultatai perkelia savireguliacijos ir visą gyvenimą trunkančio mokymosi modelius į muzikinio ugdymo sritį ir iliustruoja, kaip motyvaciniai ir reguliaciniai konstruktai sąveikauja instrumentinės pedagogikos kontekste. Praktiniu lygmeniu svarbu tai, kad, integruojant struktūruotas savireguliacijos veiklas ir vadovaujamą refleksiją į smuikininkų mokymą, galima pagerinti tiek meninį atlikimą, tiek su tvaraus mokymosi visą gyvenimą plėtojimu susijusius būsimų pedagogų ir atlikėjų gebėjimus.
Pagrindiniai žodžiai: muzikos ugdymas, smuiko pedagogika, instrumentinė praktika, mokymosi strategijos, mokymasis visą gyvenimą, aukštasis išsilavinimas, savarankiškas mokymasis.

1. Introduction

Lifelong Learning (LLL) is a dynamic and continuous process extending beyond formal education, while encompassing structured and informal experiences that promote autonomy, adaptability, and reflective engagement (Alt & Raichel, 2022; Nayak et al., 2024). Within this framework, learner-centered pedagogies such as problem-based and collaborative learning emphasize the development of independent, reflective learners capable of directing their own learning processes. Knapper and Cropley (2000) characterize lifelong learners as individuals who plan, monitor, and evaluate their learning, integrate knowledge across contexts, and apply strategies that enable them to adapt to evolving demands – principles that are closely aligned with self-regulated learning theory (Zimmerman, 2000; McPherson & Renwick, 2011).

Globally, LLL has emerged as a foundational paradigm of 21st-century education (González-Pérez & Ramírez-Montoya, 2022). Within this broader movement, music education offers a distinctive domain for examining how LLL manifests in practice. Musical training inherently demands sustained engagement, disciplined reflection, and a continuous cycle of goal setting and evaluation (Castilho et al., 2023; Benjamins et al., 2022). These qualities position instrumental education as a natural context for exploring the intersection of lifelong and self-regulated learning.

Instrumental study integrates cognitive, affective, and psychomotor domains, fostering not only technical mastery but also interpretive understanding and personal development (Schmidt, 2022; Liu et al., 2025). Among instruments, the violin poses particular cognitive and technical challenges due to its fretless design, intricate bowing mechanics, and high coordination demands (Yıldırım, 2010). Unlike fretted instruments, the absence of fixed pitch locations on the violin necessitates continuous auditory–motor calibration, requiring learners to engage in ongoing self-monitoring and error correction during performance. Similarly, the fine-grained control of the bow speed, pressure, and contact point creates a feedback-intensive motor system in which learners must constantly adjust their actions based on immediate sensory input. These characteristics position violin learning as a highly self-regulated process in which metacognitive monitoring and affective control are not supplementary but, instead, central to successful performance. In this sense, violin learning may represent an intensified form of self-regulated learning, where continuous internal feedback and error correction are more central than in many other educational or instrumental contexts. Consequently, successful learning requires systematic practice, focused attention, emotional regulation, and strategic persistence which are core competencies of both self-regulated learning and LLL (Shin, 2024; Boon, 2024).

Strategic learning behaviors such as attention focusing, rehearsal, elaboration, organization, monitoring, and affective regulation enable students to manage the complex demands of violin performance while maintaining motivation and emotional balance (Liu et al., 2023). Through these strategies, learners regulate cognitive effort, sustain persistence, and cultivate reflective habits that support lifelong artistic growth. In violin practice, these strategies manifest in highly specific forms, such as monitoring the intonation accuracy, structuring practice sequences from scales to repertoire, and regulating emotional responses to performance errors. Thus, strategic learning in this context is embedded in the moment-to-moment demands of instrumental execution rather than generalized study behaviors.

Despite a growing body of research on lifelong and strategic learning, empirical studies that examine how these two constructs interact within professional music education remain scarce and fragmented. Much of the existing scholarship has focused on general education, teacher training, or technology-enhanced learning contexts (Verkooijen et al., 2024; Thwe & Kalman, 2024; Yap & Tan, 2022), treating LLL and SRL as parallel but largely independent domains. Only a limited number of studies have extended these frameworks to the arts or music disciplines (Castilho et al., 2023; Deng et al., 2024; Pereira & Castilho, 2023; Smilde, 2021), and even these have tended to emphasize either dispositional orientations toward LLL or strategy use in musical practice – and not the dynamic interplay between them. Consequently, there remains a critical gap in understanding how LLL tendencies – such as motivation, persistence, and curiosity – interact with domain-specific self-regulatory strategies within instrumental performance, where learning is embodied, iterative, and highly individualized. Importantly, these limitations are particularly pronounced in violin education, where learning is highly individualized, feedback-dependent, and reliant on continuous self-generated evaluation. Despite these distinctive pedagogical characteristics, existing SRL and LLL frameworks have rarely been theorized in relation to the micro-level processes of violin practice, leaving a critical gap in understanding how these constructs operate within this specialized instrumental context.

Undergraduate violin students provide a particularly revealing context for investigating this gap. Given the self-regulatory demands inherent in violin performance, particularly continuous pitch adjustment and fine motor coordination, this population offers a uniquely intensive context for examining the interaction between motivational dispositions and strategic learning behaviors. These students are typically preparing for professional careers in music teaching and performance, where sustained self-regulated practice and lifelong learning are essential for continued artistic and pedagogical development. This developmental stage marks a transition from externally guided instruction to autonomous, self-directed practice, where learners must internalize reflective study habits, sustain intrinsic motivation, and regulate cognitive and emotional processes in pursuit of technical mastery. These competencies correspond closely with the LLL principles, yet how they operate together in the real-world setting of instrumental education remains empirically underexplored. Examination of the co-occurrence of motivational

persistence and metacognitive strategy use during this period thus offers an opportunity to extend self-regulated learning theory into the embodied, affectively rich, and performance-oriented practices characteristic of music education.

Accordingly, this study seeks to address these gaps through a focused empirical analysis of violin education. First, it integrates LLL and self-regulated learning frameworks within a single theoretical model, advancing conceptual understanding of how dispositional and strategic dimensions of learning intersect in a feedback-intensive, self-regulated performance domain such as violin learning. Second, it empirically investigates the relationships between specific learning strategies (attention, rehearsal, elaboration, organization, monitoring, and affective regulation) and LLL subdimensions (motivation, persistence, regulation, and curiosity), thereby clarifying the mechanisms that link enduring learning orientations with day-to-day learning behaviors. Third, it tests the contextual stability of these relationships across demographic variables such as the class level, gender, and instrumental experience, offering a more nuanced account of how individual and institutional factors shape the development of autonomous, lifelong learners in higher music education.

The study addresses the following research questions:

1. What are the levels and subdimensions of LLL tendencies among undergraduate violin students?
2. What learning strategies do these students employ in violin education?
3. How are LLL tendencies related to their use of learning strategies?
4. Do these relationships differ by the class level, gender, or instrumental experience?

By investigating these questions, the study aims to contribute theoretically, pedagogically, and globally. Theoretically, it bridges LLL and self-regulated learning perspectives within a domain where their integration has been conceptually acknowledged but seldom empirically tested. In doing so, it extends self-regulated learning theory beyond cognitive or classroom-based contexts to encompass the embodied, affective, and performative dimensions of instrumental music education. By modeling how motivational persistence and metacognitive strategy use jointly predict effective learning, the study offers a framework for understanding how dispositional and behavioral components of learning operate in tandem, thereby refining theoretical conceptions of autonomous, LLL in skill-intensive disciplines.

Pedagogically, the study provides empirical evidence to guide the design of strategy-oriented, reflective instructional environments in violin education and similar performance-based domains. By identifying which cognitive, metacognitive, and affective strategies most strongly align with LLL tendencies, it supports educators in developing structured interventions – such as guided reflection, self-monitoring protocols, and motivational scaffolding – that cultivate both technical proficiency and sustainable learning habits. This evidence-based approach contributes to transforming violin instruction from teacher-directed performance training into a learner-centered process of continuous self-development.

Globally, the study situates its findings within the international discourse on 21st-century and Education 4.0 competencies, emphasizing that self-regulation and LLL are foundational for creative adaptability in rapidly changing cultural and technological environments. By demonstrating how higher music education can function as a model for integrating reflective autonomy, emotional engagement, and strategic learning, it contributes to global educational priorities articulated by frameworks such as the *UNESCO LLL Agenda* and the *OECD Learning Compass 2030*. Thus, the study not only advances disciplinary knowledge in music pedagogy but also underscores the universal value of cultivating lifelong learners capable of sustaining artistic and professional growth across evolving educational landscapes.

2. Method

2.1. Research Design

This study adopted a quantitative, correlational design grounded in a positivist paradigm to investigate the relationship between undergraduate violin students' LLL tendencies and their use of learning strategies in violin education. The correlational approach was selected as it enables the examination of statistically significant associations among naturally occurring variables without experimental manipulation, thus preserving ecological validity (Creswell & Creswell, 2018; Cohen et al., 2018).

Two primary constructs were analyzed: LLL tendencies and learning strategy use in violin education. Both were operationalized through standardized, psychometrically validated self-report instruments. This design was deemed appropriate for identifying the direction and strength of associations between the constructs within authentic instructional settings, aligning with the study's aim to elucidate how dispositional and strategic dimensions of learning interact in the context of instrumental music education.

2.2. Data Collection Process

The data were collected during the spring semester of the 2024–2025 academic year under standardized classroom conditions. Prior to data collection, ethical approval was obtained from the Kırşehir Ahi Evran University Social and Human Sciences Research Ethics Committee (Decision No: 2024/14/14), and institutional permissions were granted by both participating universities. All participants were informed of the purpose, procedures, and the voluntary nature of the research and were assured that their decision to participate – or to withdraw at any point – would bear no academic consequences. To ensure anonymity and confidentiality, no identifying information was collected, and the responses were coded numerically for analysis. All data were stored securely on a password-protected device accessible only to the principal researcher and will be retained for five years following the publication before being permanently deleted in accordance with institutional data management policies. The study adhered to the ethical principles of the Declaration of Helsinki (2013) and to the APA and COPE guidelines for research integrity and participant protection.

The two scales were completed consecutively in a single 25–30-minute session under the researcher's supervision. Questionnaires were reviewed for completeness before data entry into *IBM SPSS Statistics 26.0*; incomplete or inconsistent responses were excluded. All data were anonymized by using coded identifiers and securely stored in password-protected files accessible only to the research team. Conducting the administration in familiar classroom environments ensured participant comfort and consistency across the institutions, thereby enhancing the reliability and internal validity of the data collected.

2.3. Participants

The study involved 40 undergraduate violin students enrolled in music education programs at two Turkish universities. These institutions were purposefully selected because they represent nationally accredited teacher-training programs that combine individual performance, ensemble participation, and pedagogical coursework – which are core components standardized across Turkey's higher music education system. Both universities adhere to the Council of Higher Education's national curriculum framework, which defines the program outcomes, instructional methods, and assessment practices for music education departments. This alignment ensures that the sample accurately reflects the structural and pedagogical characteristics of undergraduate violin instruction within the country.

The participants were recruited through convenience sampling, as data collection was limited to institutions granting formal research permission. Although this sampling strategy restricts broad generalizability, it captures the typical demographic and instructional profile of violin students in Turkish higher education, where curricula and pedagogical approaches exhibit high degrees of national uniformity.

Of the 40 participants, 37 (92.5%) were female and 3 (7.5%) were male. Class-level distribution included first-year (n = 9), second-year (n = 9), third-year (n = 13), and fourth-year (n = 9) students across both institutions. The participants reported an average of 4–8 years of formal violin study, encompassing both pre-university and undergraduate training. All students were actively engaged in individual violin instruction, ensemble performance, and musicianship courses, thereby ensuring comparable learning conditions and exposure to standardized pedagogical practices across the two sites. The participants were enrolled in undergraduate music education programs with a primary focus on violin performance, preparing for professional roles as music educators and/or performers within the Turkish higher music education system.

2.4. Data Collection Instruments

The data were collected by using two standardized self-report instruments: the *Violin Education Learning Strategies Scale* (VELSS) (Afacan, 2018) and the *Lifelong Learning Tendencies Scale* (LLTS) (Diker-Coşkun & Demirel, 2010). Both instruments were selected for their strong psychometric properties and conceptual alignment with the

study's aim of examining the relationship between strategic learning behaviors and lifelong learning dispositions in violin education.

The VELSS was developed to assess the cognitive and affective strategies that students employ during violin practice and performance. It consists of 67 items rated on a five-point Likert scale ('1' = Never, '5' = Always), measuring six subdimensions: Monitoring, Attention, Organization, Elaboration, Rehearsal, and Affective Strategies. The scale demonstrated excellent internal consistency (Cronbach's $\alpha = .97$) and sound construct validity in previous studies, providing a domain-specific measure of strategic learning behaviors in instrumental contexts (Afacan, 2018).

The LLTS evaluates learners' lifelong learning orientations across four dimensions – Motivation, Persistence, Regulation of Learning, and Curiosity – using 27 items rated on a six-point Likert scale (from '1' = Strongly disagree to '6' = Strongly agree). Higher scores indicate stronger lifelong learning tendencies. The LLTS scale has shown high internal reliability (Cronbach's $\alpha = .89$) and validity across Turkish higher education contexts (Diker-Coşkun & Demirel, 2010).

Prior to the main data collection, both instruments underwent expert review and pilot testing to ensure contextual appropriateness and linguistic clarity for the target population. Three specialists in music education and educational psychology reviewed the scales for content validity, clarity of expression, and alignment with the conceptual domains of self-regulated and lifelong learning. Minor linguistic and contextual revisions were made to adapt certain items to violin-specific learning situations (e.g., intonation control, bowing techniques, and structured practice routines). A pilot study with 12 violin students from a non-participating university was conducted to assess the item comprehensibility, and to verify the internal consistency of the research instruments. The pilot yielded reliability coefficients of $\alpha = .95$ for the VELSS and $\alpha = .87$ for the LLTS, confirming their suitability for the main study. Formal permission for the use and adaptation of the VELSS and LLTS instruments was obtained from the original authors, and all instruments were applied in accordance with their respective usage guidelines.

In the present sample, the internal consistency coefficients ranged from $\alpha = .84$ to .96 across all subdimensions, thus indicating high reliability of both instruments within the context of Turkish higher music education.

Both research instruments were administered consecutively during regular violin education classes under the supervision of the researcher so that to ensure standardized conditions and minimize external interference. The combination of these validated and contextually adapted measures provided a robust basis for analyzing how self-regulated learning strategies and lifelong learning tendencies interact within the specialized domain of violin education.

2.5. Data Analysis

All statistical analyses were performed by using *IBM SPSS Statistics 26.0* (IBM Corp., 2019) at a significance level of $p<.05$. The analytic procedure followed four sequen-

tial stages: (1) data screening and cleaning, (2) computation of composite and subscale scores, (3) verification of statistical assumptions, and (4) application of descriptive and inferential analyses consistent with the study's research questions.

Descriptive statistics (minimum, maximum, mean, and standard deviation) were calculated for all variables to summarize the participants' responses. Internal consistency reliability was examined by using Cronbach's alpha coefficients, which ranged from .78 to .94, thus confirming high internal reliability for both the VELSS and the LLTS. For interpretive clarity, the mean scores for each scale were categorized as low, moderate, or high according to predetermined score intervals.

Prior to inferential testing, the normality assumption was evaluated by using the Shapiro–Wilk test and visual inspection of histograms and Q–Q plots. Due to the fact that most variables deviated from a normal distribution, nonparametric procedures were selected to provide robust, distribution-free estimates appropriate for ordinal Likert-scale data and small sample sizes.

For the first and second research questions, descriptive analyses were used to summarize the overall levels and subdimensions of the lifelong learning tendencies and learning strategy use. For the third question, Spearman's rank-order correlation (ρ) was applied to examine the direction and strength of relationships between lifelong learning subdimensions and strategic learning behaviors. Correlation coefficients were interpreted according to Cohen's (1988) guidelines: $\rho \approx .10$ (weak), $\rho \approx .30$ (moderate), and $\rho \approx .50$ (strong). For the fourth research question, the group differences were analyzed by using the Mann–Whitney U test (for two-category comparisons by university), and the Kruskal–Wallis H test (for four-category comparisons by class level). When significant differences were detected, Dunn–Bonferroni *post-hoc* tests were conducted in order to identify the sources of variation.

To assess the statistical adequacy of the analyses, the effect sizes and statistical power were also examined in accordance with the *APA 7* guidelines. The effect sizes (Cohen's r and η^2) were calculated for all correlation and group comparison tests to estimate the magnitude of the observed relationships. A *post-hoc* power analysis conducted by using G*Power 3.1 indicated an average statistical power of 0.81 to detect medium-sized effects ($r = .40$, $\alpha = .05$), thereby suggesting that the sample size was sufficient to identify meaningful associations between lifelong learning dispositions and strategic learning behaviors. Reporting both the effect size and the power enhances methodological transparency, thus ensuring that the findings are evaluated not only for statistical significance but also for their practical and theoretical importance.

All analyses and tables were presented in accordance with the APA 7th edition standards. The tables were consecutively numbered, accompanied by explanatory footnotes specifying statistical tests, sample sizes, and significance thresholds. Statistically significant results were denoted with asterisks ($p<.05$, $p<.01$).

3. Findings

3.1. Findings from the Lifelong Learning Tendencies Scale

The first research question examined the extent of undergraduate violin students' LLL tendencies as measured by the four subdimensions of the LLTS: Motivation, Persistence, Lack of Regulation in Learning, and Lack of Curiosity. Table 1 summarizes the descriptive statistics for each subdimension.

Table 1. *Descriptive statistics for the lifelong learning tendencies scale and its subdimensions among violin students*

Dimension	Min	Max	M	SD	Interpretation
Motivation	3.83	6.00	5.47	0.50	High
Persistence	3.17	6.00	4.95	0.76	High
Lack of Regulation in Learning	1.00	4.83	1.98	0.90	Low
Lack of Curiosity	1.00	4.89	2.25	0.94	Low

Overall, students demonstrated strong LLL orientations, reflected in high levels of motivation (M = 5.47) and persistence (M = 4.95). These results indicate a pronounced willingness to engage with learning challenges and maintain sustained effort over time. Conversely, the negatively keyed dimensions – Lack of Regulation in Learning (M = 1.98) and Lack of Curiosity (M = 2.25) – registered low mean scores, thus suggesting minimal deficits in self-regulation and curiosity.

Taken together, these findings portray a learner profile characterized by intrinsic motivation, persistence, and self-directed engagement, which is consistent with the dispositions of autonomous, reflective learners. Such profiles are central to the development of self-regulated learning competencies, which integrate motivational and metacognitive control (Zimmerman, 2000).

In theoretical terms, the data affirm that students' strong motivational and regulatory capacities support their capacity for lifelong, self-directed learning – which is a foundation crucial for continuous growth in instrumental performance and professional artistry.

3.2. Findings from the Violin Learning Strategies Scale

The second research question investigated the frequency with which students used the strategy categories on the VLSS. To improve readability and emphasize interpretation, the results are reported at the subscale level; item-level statistics are provided in Appendix A.

The students reported frequent use of metacognitive and structural strategies – Organization and Monitoring Comprehension (both M = 4.45) – along with Repetition–Rehearsal (M = 4.32). This pattern indicates strong engagement in planning/structuring practice, detecting and correcting errors, and systematic repetition to consolidate technique. Elaboration (M = 3.88) and Affective strategies (M = 3.85) were moderately high, thus suggesting regular use of meaning-making, reflection, and positive emotional regu-

lation during practice. By contrast, Attention was moderate (M = 3.25), which points to attentional control and cue-marking as comparatively underdeveloped areas.

Table 2. *Descriptive statistics for VLSS subscales*

Subscale	Min	Max	M	SD	Interpretation
Attention	1.08	5.31	3.25	0.95	Moderate
Repetition–Rehearsal	2.18	5.00	4.32	0.61	High
Elaboration	1.88	5.00	3.88	0.87	Moderately high
Organization	3.00	5.00	4.45	0.81	High
Monitoring Comprehension	3.12	5.00	4.45	0.44	High
Affective	—	—	3.85	0.79	Moderately high

Note. VLSS uses a 5-point scale ('1' = *Never*, '5' = *Always*). Interpretation bands: 1.00–2.33 = low; 2.34–3.66 = moderate; 3.67–5.00 = high.

The profile depicts learners who already leverage self-regulatory routines (planning, monitoring, rehearsal) but would likely benefit from targeted instruction that strengthens attentional focusing and cueing (e.g., structured attentional checklists, score annotation protocols, deliberate-focus intervals). Such supports can increase the efficiency and depth of practice and complement students' existing metacognitive strengths.

Internal consistency for the VLSS subscales was satisfactory to excellent in this sample ($\alpha \approx .79$–$.94$). Detailed item means/SDs (e.g., highest items reflecting goal-oriented planning and immediate error correction; lowest items reflecting attentional cueing) are retained in Appendix A to preserve visual economy in the main text.

3.3. The Relationship between Lifelong Learning Tendencies and Learning Strategies in Violin Education

The third research question explored the associations between the students' LLL tendencies and their use of learning strategies in violin education. Since normality assumptions were not met, Spearman's rank-order correlation coefficients (ρ) were calculated. The results are summarized in Table 3.

Table 3. *Spearman's correlation coefficients between lifelong learning tendencies and learning strategies of violin students*

Variables	Motivation	Persistence	Deficiency in Regulating Learning	Lack of Curiosity
Attention Strategies	.14	.23	.19	−.09
Repetition–Rehearsal	.40*	.37*	−.08	−.06
Elaboration	.26	.43**	.09	−.08
Organization	.51**	.52**	−.12	−.17
Monitoring Comprehension	.43**	.47**	−.04	−.16
Affective	.51**	.57**	.04	−.14

Note. **p<.05, *p<.01 (two-tailed).

The correlation analysis revealed consistent and positive associations between adaptive learning strategies and LLL tendencies, particularly within the domains of motivation and persistence. Strong relationships emerged for organization ($\rho = .51–.52$), monitoring comprehension ($\rho = .43–.47$), and affective strategies ($\rho = .51–.57$), all reflecting large effect sizes. These findings suggest that the students who engage in structured, metacognitive, and emotionally invested approaches to practice are more likely to sustain motivation and perseverance in their learning processes.

Repetition–rehearsal and elaboration also showed moderate positive correlations with motivational and persistence-oriented traits ($\rho \approx .37–.43$), indicating that systematic repetition and meaningful connection-making reinforce learners' engagement and endurance. In contrast, attention strategies showed weaker, nonsignificant correlations, implying that attentional control alone may not sufficiently predict broader LLL orientations.

Conversely, the less adaptive subdimensions – deficiency in regulating learning and lack of curiosity – displayed either nonsignificant or negative relationships with most strategy types. In particular, lack of curiosity correlated negatively with motivation ($\rho = -.37$, $p<.05$) and persistence ($\rho = -.45$, $p<.01$), thereby suggesting that diminished intrinsic curiosity undermines sustained motivational engagement.

Overall, these results indicate a mutually reinforcing relationship between LLL dispositions (motivation, persistence) and self-regulated learning strategies (organization, monitoring, and affective regulation). Violin students who demonstrate higher self-regulatory control and metacognitive awareness are also those who sustain intrinsic motivation and emotional commitment to their musical growth. This interplay aligns with Zimmerman's (2000) self-regulated learning framework, emphasizing the cyclical interaction between strategic planning, self-monitoring, and motivational persistence in expert skill development.

3.4. Learning Strategies and Lifelong Learning Tendencies

3.4.1. Differences by University

This section investigated whether students' learning strategies and LLL tendencies differed according to the university they attended. Because normality assumptions were not met, comparisons were made using the Mann–Whitney U test. The results are presented in Table 4.

No statistically significant differences were found between universities across any subdimension of either the VLSS or the LLTS ($p>.05$). Effect sizes were uniformly small ($r<.30$), indicating negligible practical differences.

These findings suggest that the students' strategic learning behaviors and LLL dispositions are largely consistent across institutional contexts. In other words, violin students from different universities exhibit comparable levels of motivation, persistence, and strategic engagement in their practice and learning processes.

Table 4. *Differences in learning strategies and lifelong learning tendencies by university variable (Mann–Whitney U test results)*

Variable	U	Z	p	Result
Attention Strategies	188.50	−0.18	.860	n.s.
Repetition (Rehearsal) Strategies	185.00	−0.20	.839	n.s.
Elaboration Strategies	176.00	−0.41	.684	n.s.
Organization Strategies	182.50	−0.23	.818	n.s.
Monitoring Comprehension Strategies	170.00	−0.68	.497	n.s.
Affective Strategies	184.50	−0.21	.828	n.s.
Motivation	189.00	−0.14	.891	n.s.
Persistence	175.50	−0.58	.559	n.s.
Deficiency in Regulating Learning	152.00	−1.69	.091	n.s.
Lack of Curiosity	181.00	−0.16	.871	n.s.

Note. Mann–Whitney U test was applied. The significance level was set at $p<.05$. Negative Z values result from the comparison of mean ranks. $N_1 = 20$, $N_2 = 20$. n.s. = not significant.

The absence of significant institutional differences may reflect the standardization of violin pedagogy and curriculum design in Turkish higher music education, where instructional philosophies and assessment criteria are broadly aligned. This homogeneity likely promotes similar self-regulatory and motivational profiles among students, regardless of university affiliation. From a broader perspective, such uniformity indicates that the institutional culture exerts less influence on self-regulated learning behaviors than individual learner characteristics and teacher–student interactions.

3.4.2. Differences by Grade Level

This section investigates whether the violin students' learning strategies and LLL tendencies differ according to the grade level. Due to the fact that the data were not normally distributed, as confirmed by the Shapiro–Wilk test, comparisons were conducted by using the nonparametric Kruskal–Wallis H test. The results are presented in Table 5.

No statistically significant differences emerged among grade levels on any dimension of learning strategies or LLL tendencies ($p>.05$). All effect sizes were small to negligible (η^2_H <.15), thus suggesting that the observed variations – such as slightly higher affective strategy scores among second-year students – were not educationally meaningful.

The results indicate that self-regulated learning strategies and LLL dispositions remain stable throughout undergraduate violin education. This uniformity may reflect the continuity of instructional philosophy, assessment criteria, and teacher guidance across all four years of study. From a developmental perspective, the findings align with self-regulation theory (Zimmerman, 2000), suggesting that once foundational metacognitive and motivational patterns have been established in early training, they tend to stabilize rather than vary significantly by academic year.

Table 5. *Differences in learning strategies and lifelong learning tendencies by grade level (Kruskal–Wallis H test results; N = 40)*

Variable	H(χ^2)	df	p	η^2H	Result
Attention Strategies	0.12	3	.990	.00	n.s.
Repetition–Rehearsal	0.70	3	.874	.01	n.s.
Elaboration	3.00	3	.392	.08	n.s.
Organization	1.86	3	.601	.04	n.s.
Monitoring Comprehension	0.19	3	.980	.00	n.s.
Affective	5.89	3	.117	.15	n.s.
Motivation	1.91	3	.590	.05	n.s.
Persistence	1.56	3	.668	.04	n.s.
Deficiency in Regulating Learning	2.31	3	.511	.06	n.s.
Lack of Curiosity	4.95	3	.176	.12	n.s.

Note. Kruskal–Wallis H test was applied; significance threshold α = .05 (two-tailed). Effect size η²_H = (H − k + 1)/(N − k), where *k* = number of groups (Tomczak & Tomczak, 2014). Group sizes: 1st year = 9, 2nd = 9, 3rd = 13, 4th = 9 (total N = 40).

Such stability may be pedagogically beneficial, ensuring that students maintain consistent engagement and motivation; however, it also points to a need for differentiated interventions – particularly in later years – to further challenge and extend the students' strategic independence and reflective capacities.

4. Discussion

4.1. Summary of Results

This study investigated the relationship between the LLL tendencies and the learning strategy use among undergraduate violin students enrolled in two Turkish universities. By using validated self-report measures, the research examined (a) the overall levels of LLL and learning strategy engagement, (b) the relationships between these constructs, and (c) possible differences by institution and the grade level.

The findings revealed that the participants demonstrated high levels of LLL tendencies, characterized by strong motivation and persistence, and low scores on the reverse-coded dimensions (lack of regulation in learning and lack of curiosity). These results indicate that violin students in the sample generally possess positive dispositions toward continuous learning, self-direction, and intellectual curiosity – which are core components of LLL frameworks. Students reported moderate-to-high engagement in a broad range of learning strategies, with the highest mean scores in organization, monitoring comprehension, and repetition–rehearsal. These subdimensions reflect structured planning, metacognitive self-monitoring, and systematic practice, all of which are hallmarks of self-regulated learning. In the context of violin learning, these patterns likely reflect the students' engagement in structured practice routines (e.g., progressing from scales to repertoire), continuous monitoring of intonation accuracy, refinement of bow-

ing control, and iterative correction of technical errors through repetition. Such behaviors align with the real-time demands of violin performance, where error detection and adjustment occur continuously during practice and are often guided by close attention to both sound production and score-based musical interpretation. Affective and elaboration strategies were also used frequently, whereas attention strategies – such as concentration and cue-marking – were comparatively less developed, thus suggesting a potential pedagogical area for enhancement.

Correlation analyses demonstrated moderate-to-strong positive associations between LLL tendencies – especially motivation and persistence – and adaptive learning strategies such as organization, monitoring comprehension, and affective engagement. These findings support the premise that motivational persistence and metacognitive regulation are mutually reinforcing within instrumental practice (Zimmerman, 2000; McPherson & Renwick, 2011). In violin contexts, this relationship is reflected in the students' sustained engagement with practice activities such as refining intonation, coordinating bowing technique, and revisiting challenging passages through detailed score study, all of which require continuous feedback-based adjustment. Conversely, the reverse-coded dimensions (deficiency in regulating learning and lack of curiosity) showed weak or negative associations, thus indicating that lower intrinsic curiosity may hinder sustained motivation and strategic engagement.

No significant differences emerged between students from different universities or across the grade levels. The effect sizes were uniformly small, thus suggesting that the institutional context and academic year exert minimal influence on the students' learning dispositions and strategies. This homogeneity likely reflects the standardized structure of Turkish higher music education, where curricula, instructional methods, and performance expectations are broadly aligned.

Collectively, the findings portray undergraduate violin students as highly motivated, strategically organized, and emotionally engaged learners who approach their musical development with sustained effort and reflective awareness. Within violin pedagogy, this profile reflects learners who are capable of independently identifying and correcting performance errors between lessons, including issues related to intonation, bowing technique, and score interpretation, which is a critical requirement in studio-based instructional models. The positive interdependence between LLL orientation and learning strategy use underscores the integrative nature of self-regulated musicianship, in which cognitive, metacognitive, and motivational processes operate synergistically to support continuous skill refinement and autonomy in learning. These patterns are consistent with the established traditions of violin pedagogy, in which, technical refinement, iterative practice, and score-based interpretation are developed through sustained, self-regulated engagement.

4.2. Theoretical Implications

Grounded in Self-Regulated Learning Theory (Zimmerman, 2000) and informed by the concept of LLL dispositions as articulated in Turkish higher education research (Diker-Coşkun, 2009; Gencel, 2013), this study contributes theoretically to understanding

how motivational, metacognitive, and affective processes interact within instrumental music education. In violin learning, these processes are enacted through continuous auditory–motor feedback loops, where learners must simultaneously plan, execute, monitor, and adjust their performance in real time. These processes are concretely manifested in violin tasks such as intonation adjustment, bowing coordination, and score-based interpretive decision-making. The findings demonstrate that undergraduate violin students exhibit strong LLL orientations – particularly in motivation and persistence – together with extensive use of organizational, monitoring, and rehearsal-based strategies. These results empirically substantiate SRL models by illustrating how motivation and strategic regulation function as reciprocal mechanisms that sustain continuous self-improvement in long-term, skill-based learning contexts such as violin performance.

Previous studies in music education have typically examined either LLL (e.g., Castilho et al., 2023; Smilde, 2021) or learning strategies (e.g., Afacan & Topaloğlu, 2021; Carrillo & González-Moreno, 2025; Liu et al., 2023; Wen, 2024) in isolation. By integrating these two domains, this study provides theoretical evidence for their systemic interdependence, showing that LLL dispositions (trait-like motivational orientations) underpin the effective use of self-regulatory strategies (state-like behaviors). The significant positive correlations between motivation, persistence, and metacognitive strategies validate Zimmerman's (2000) triadic model of forethought, performance, and self-reflection, confirming that these phases are not only cyclical but also dispositionally anchored. The absence of significant differences across universities or grade levels further implies that learner-driven mechanisms, rather than contextual or curricular factors, play the dominant role in sustaining self-regulation thus echoing Bonnaire and González-Moreno's (2023) findings on the durability of metacognitive awareness in instrumental learning.

Conceptually, the study advances theory by situating LLL tendencies (a relatively stable motivational–attitudinal orientation) and learning strategies (dynamic, context-dependent actions) as mutually reinforcing dimensions of self-regulated musicianship. Whereas earlier research (e.g., Brocklehurst, 2025; Feldman et al., 2020) highlighted isolated strategy types – such as repetition or organization – the present results suggest that effective self-regulation in instrumental learning emerges from a multidimensional orchestration of cognitive, metacognitive, and affective components. This is particularly evident in violin performance, where cognitive, motor, and perceptual processes are tightly integrated, requiring learners to coordinate metacognitive awareness with fine-grained motor control. Emotional engagement and persistence appear to mediate the application of metacognitive control, emphasizing that affective regulation is not peripheral but constitutive of SRL in embodied performance domains.

The observed stability of these relationships across grade levels and institutions delineates both the robustness and the theoretical boundaries of the SRL–LLL linkage. In the case of violin education, this stability may reflect the early internalization of practice routines centered on intonation control, structured repetition, and self-evaluation. Once learners internalize motivational and strategic frameworks early in their training, they appear to sustain consistent self-regulatory patterns over time. However, this constancy

may be domain- and expertise-sensitive, varying in earlier developmental stages or in externally regulated contexts such as ensemble performance. Future theoretical models should therefore account for how embodiment, feedback immediacy, and affective investment shape self-regulatory processes differently in performance-based learning compared to classroom or cognitive domains.

Overall, this study offers a theoretically grounded model which unites LLL dispositions with self-regulated practice behaviors, conceptualizing musical expertise as a lifelong, self-sustaining process driven by the interplay of motivation, cognition, and emotion. By empirically linking dispositional orientations to dynamic strategic processes, the research refines SRL theory and enriches educational psychology and music pedagogy alike – while highlighting that autonomous musicianship is not merely a skill set, but an enduring, self-regulated pursuit of growth.

4.3. Practical Implications

The findings of this study carry significant pedagogical, institutional, and policy implications for violin education and higher music pedagogy. The strong correlations between motivational persistence and metacognitive strategies such as organization and monitoring underscore the centrality of SRL in cultivating reflective, autonomous musicians. At the instructional level, violin educators can enhance students' self-regulatory competence by embedding explicit strategy-based instruction into studio lessons – emphasizing goal setting, planning, progress monitoring, and self-evaluation. For example, instructors can guide students in structuring practice sessions that begin with intonation-focused scale work, followed by targeted technical exercises and repertoire refinement, supported by systematic self-monitoring of the pitch and tone production. Structured tools such as practice journals, self-assessment rubrics, and guided reflection sessions can promote metacognitive awareness and sustained engagement, transforming daily practice into an intentional, self-directed process.

The relatively lower use of attention-control strategies highlights an area for targeted pedagogical intervention. Instructors may integrate focused listening exercises, mindfulness-based concentration practices, and segmented rehearsal routines to strengthen selective attention and cognitive flexibility. In violin contexts, this may include techniques such as isolating difficult passages, annotating scores with bowing and intonation cues, and using slow practice to enhance perceptual awareness. These methods not only enhance technical precision but also develop the learners' capacity to manage mental focus during extended practice sessions – which is an essential attribute for long-term artistic growth.

The prominence of affective strategies observed among the participants further reveals that emotional engagement and enjoyment serve as enduring motivators for sustained learning. Educators should thus foster emotionally supportive and autonomy-promoting environments that encourage repertoire personalization, creative goal setting, and collaborative reflection. Given the error-sensitive nature of violin performance, such

approaches are particularly important for helping students manage frustration associated with intonation inconsistencies and repetitive technical refinement. By validating the students' intrinsic interests and emotional expression, teachers can reinforce self-determination and nurture dispositions aligned with lifelong learning.

At the programmatic and institutional levels, the consistency of findings across universities and grade levels suggests a broadly shared pedagogical foundation, yet also signals the need for systematic scaffolding of SRL and LLL competencies throughout the music curriculum. Departments of music education could integrate self-regulated learning modules – covering practice management, reflective performance, and metacognitive awareness – into core coursework and ensemble programs. Establishing formal mentorship systems, reflective performance portfolios, and peer-coaching schemes would further promote continuity in students' motivational and strategic development.

To align with the contemporary educational trends, institutions should also leverage digital technologies to support reflective practice and data-informed learning. The use of online logbooks, digital self-assessment tools, AI-assisted feedback systems, and virtual masterclasses can modernize the learning ecosystem, enabling students to monitor progress and receive personalized insights. These innovations bridge traditional instrumental instruction with emerging Education 4.0 paradigms, positioning music education within a digitally mediated lifelong learning continuum.

Finally, the implications of this study extend beyond student learning to the ongoing professional development of music educators. Teacher education programs and professional development initiatives should embed the SRL and LLL principles into their frameworks, equipping instructors to model reflective practice, adaptive expertise, and technological fluency. By linking student autonomy with teacher lifelong learning, institutions can create a sustainable pedagogical culture which fosters continuous growth, innovation, and resilience within higher music education.

4.4. Limitations and Suggestions for Future Research

Although this study contributes valuable insights into the relationship between the LLL tendencies and learning strategies in violin education, several limitations must be acknowledged in order to contextualize the findings and guide future inquiry.

Methodological Limitations

From a methodological standpoint, the relatively small sample size, while sufficient for correlational analysis, constrains the statistical power and limits the generalizability of the results. Expanding future studies to include larger and more heterogeneous samples across conservatories, universities, and national contexts would enable stronger inferential validity and comparative depth. Additionally, reliance on self-report instruments may have introduced social desirability and recall biases, as the participants might overestimate or underestimate their actual learning behaviors. Future investigations could mitigate these issues by adopting mixed-method triangulation, integrating quantitative scales with qualitative approaches – such as interviews, think-aloud protocols, or digital

trace analyses of practice behavior – to yield richer, ecologically valid data. Moreover, the cross-sectional design precludes causal interpretations. Longitudinal or experimental studies following students across multiple academic years could elucidate how LLL dispositions and self-regulatory strategies co-evolve and determine the temporal directionality of these relationships.

Contextual Limitations

Contextually, the research was confined to undergraduate violin students within Turkish higher music education. While this population represents a valuable case for examining the interplay between motivation and strategic learning, the findings cannot be readily generalized to other performance domains or educational cultures. Future work should therefore pursue cross-instrumental (e.g., piano, voice, wind instruments) and ensemble-based comparisons to explore how varying technical and social demands shape self-regulatory processes. In addition, cross-cultural studies could examine whether the interdependence of lifelong and self-regulated learning holds across educational traditions characterized by differing pedagogical philosophies, motivational norms, or collectivist versus individualist learning orientations. Such comparative designs would clarify which aspects of the SRL–LLL relationship are universal and which are context-dependent. Furthermore, the violin's unique technical and perceptual demands may limit the transferability of these findings to other instrumental domains that rely on different feedback systems and motor processes.

Theoretical and Technological Considerations

Theoretically, the study applied established frameworks of lifelong and self-regulated learning but did not introduce or test a comprehensive model explaining their integration in instrumental contexts. Future research should seek to develop and validate structural models – for instance, through structural equation modeling – that specify the mediating and moderating roles of motivation, metacognition, and affective regulation. Additionally, as digital technologies become increasingly embedded in music education, researchers should examine how AI-supported learning platforms, digital metacognitive tools, and practice-tracking applications influence the students' self-regulation, feedback use, and sustained motivation. Such investigations would extend SRL and LLL theory into the emerging paradigms of Education 4.0 and LLL 5.0, while aligning music pedagogy with the contemporary shifts towards hybrid and technology-enhanced learning ecosystems.

5. Conclusion

This study demonstrated that undergraduate violin students possess strong LLL orientations – marked by high motivation and persistence – which closely align with the frequent use of cognitive and metacognitive strategies such as organization, monitoring, and rehearsal. The significant correlations between motivational dispositions and stra-

tegic behaviors indicate that SRL and LLL function as mutually reinforcing processes within the feedback-intensive and self-regulated context of violin education. Theoretically, these findings extend the existing SRL and LLL frameworks by illustrating how motivation, persistence, and metacognitive control integrate in a domain that is both skill-intensive and affectively rich. Pedagogically, they highlight the importance of embedding reflective, strategy-based learning practices into violin education to promote autonomy, sustained engagement, and self-directed artistic development. On a global level, the study reinforces the view that cultivating reflective, self-regulating learners is essential to achieving the broader aims of 21st-century higher education and LLL for creative disciplines.

References

Afacan, Ş. (2018). *Development of the Violin Education Learning Strategies Scale and the effects of strategy-based activities on students' use of learning strategies and violin performance* [Doctoral dissertation, Gazi University]. Institute of Educational Sciences, Ankara, Turkey.

Afacan, Ş., & Topaloğlu, T. (2021). The use of learning strategies of the music teacher candidates receiving string instruments training. *International Journal of Education Technology and Scientific Researches, 6*(14), 431–476. https://doi.org/10.35826/ijetsar.290

Alt, D., & Raichel, N. (2022). Problem-based learning, self-and peer assessment in higher education: towards advancing lifelong learning skills. *Research Papers in Education*, *37*(3), 370–394. https://doi.org/10.1080/02671522.2020.1849371

An, F., Xi, L., & Yu, J. (2024). The relationship between technology acceptance and self-regulated learning: the mediation roles of intrinsic motivation and learning engagement. *Education and Information Technologies*, *29*(3), 2605–2623. https://doi.org/10.1007/s10639-023-11959-3

Benjamins, L., Roland, S. L., & Bylica, K. (2022). The complexities of meaningful experiential learning: Exploring reflective practice in music performance studies. *International Journal of Music Education*, *40*(2), 163–176. https://doi.org/10.1177/02557614211043224

Bonnaire, S., & González-Moreno, P. (2023). Developing metacognition as an instructional approach for enhancing young pianists' musical expressivity. *International Journal of Music Education*, *41*(2), 199–210. https://doi.org/10.1177/02557614221115805

Boon, İ. E. T. (2024). Self-Regulated Learning Skills in Instrument Education: A Qualitative Study. *International Journal of Education and Literacy Studies*, *12*(1), 106–114. http://dx.doi.org/10.7575/aiac.ijels.v.12n.1p.106

Brocklehurst, J. B. (2025). *Response to Music: Principles of Music Education* (1st ed.). Routledge. https://doi.org/10.4324/9781003617709

Campbell, M. R., Thompson, L. K., & Barrett, J. R. (2021). *Constructing a Personal Orientation to Music Teaching: Growth, Inquiry, and Agency* (2nd ed.). Routledge. https://doi.org/10.4324/9780429327346

Carrillo, R., & González-Moreno, P. A. (2025). Formal and informal music learning strategies: Instrument development and validation. In R. M. Serrano, G. López-Íñiguez, J. L. Aróstegui, Gwen Moore (Eds.), *Research Perspectives on Music Education in Ibero-America* (pp. 143–156). Routledge. https://doi.org/10.4324/9781003490579

Castilho, L. C., Pereira, C., & Castilho, F. M. (2023). The Role of Music in Lifelong Learning. In M. J. Guardado Moreira, L. S. A. Carvalho, P. J. Sequeira Gonçalves, & V. M. Barreiros Pinheira (Eds.), *Longevity and Development: New perspectives on Ageing Communities* (pp. 1–18). Springer International Publishing. https://doi.org/10.1007/978-3-031-22273-3_1

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates. https://doi.org/10.4324/9780203771587

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*(1), 155–159. https://doi.org/10.1037/0033-2909.112.1.155

Cohen, L., Manion, L., & Morrison, K. (2018). *Research Methods in Education* (8th ed.). Routledge.

Coşkun, Y. D., & Demirel, M. (2010). Lifelong learning tendency scale: The study of validity and reliability. *Procedia - Social and Behavioral Sciences*, *5*, 2343–2350. https://doi.org/10.1016/j.sbspro.2010.07.461

Creswell, J. W., & Creswell, J. D. (2018). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (5th ed.). SAGE Publications.

Deng, R., Roslan, S., Ma'rof, A. M. B., Zaremohzzabieh, Z., & Yin, Y. (2024). Exploring the Foundations of Lifelong Learning: How Educational Games and Music Shape Children's Behavior, Educational Experiences and Environments. *Educational Administration: Theory and Practice*, *30*(3), 86–104. https://doi.org/10.52152/kuey.v30i3.960

Diker Coşkun, Y. (2009). *Examination of university students' lifelong learning tendencies in terms of certain variables* [Doctoral dissertation, Hacettepe University]. Institute of Social Sciences, Department of Educational Sciences, Curriculum and Instruction, Ankara, Turkey.

Evin Gencel, İ. (2013). Prospective Teachers' Perceptions towards Lifelong Learning Competencies. *Education and Science*, *38*(170), 237–252. https://doi.org/10.15390/ES.2013.1199

Feldman, E., Lutch, M., Contzius, A., & Bugaj, K. (2020). *Instrumental music education: Teaching with the musical and practical in harmony*. Routledge.

García-Toledano, E., Gracia-Zomeño, A., Farinho, P., & Picado, L. M. C. M. (2023). Analyzing Teachers' Perception of the Development of Lifelong Learning as Personal, Social and Learning to Learn Competence in University Students. *Education Sciences*, *13*(11), Article 1086. https://doi.org/10.3390/educsci13111086

González-Pérez, L. I., & Ramírez-Montoya, M. S. (2022). Components of Education 4.0 in 21st century skills frameworks: systematic review. *Sustainability*, *14*(3), Article 1493. https://doi.org/10.3390/su14031493

Yap, J. S., & Tan, J. (2022). Lifelong learning competencies among chemical engineering students at Monash University Malaysia during the COVID-19 pandemic. *Education for Chemical Engineers*, *38*, 60–69. https://doi.org/10.1016/j.ece.2021.10.004

IBM Corp. (2019). *IBM SPSS Statistics for Windows* (Version 26.0). Armonk, NY: IBM Corp.

Yıldırım, K. (2010). Kodaly Yönteminin İlköğretim Öğrencilerinin Keman Çalma Becerisi Üzerindeki Etkisi=The effects of the Kodály method on primary school students' violin performance skills. *Batı Anadolu Eğitim Bilimleri Dergisi=The Western Anatolia Journal of Educational Sciences*, *1*(2), 140–149. https://izlik.org/JA89HC82XX

Knapper, C., & Cropley, A. (2000). *Lifelong learning in higher education* (3rd ed.). London, England: Kogan Page.

Liu, C., Hwang, G.-J., Tu, Y., Yin, Y., & Wang, Y. (2023). Research advancement and foci of mobile technology-supported music education: A systematic review and social network analysis on 2008-2019 academic publications. *Interactive Learning Environments*, *31*(7), 4535–4554. https://doi.org/10.1080/10494820.2021.1974890

Liu, V. F., Ho Weatherly, K. I. C., & Cheng, C. (2025). Conceptualising instrumental practice among Chinese American children, their parents, and teachers: Self-regulation, cultural mediation, and filial piety. *Music Education Research*, *27*(5), 559–576. https://doi.org/10.1080/14613808.2025.2548283

López-Calatayud, F., & Tejada, J. (2024). Self-regulation strategies and behaviors in the initial learning of the viola and violin with the support of software for real-time instrumental intonation assessment. *Research Studies in Music Education*, *46*(1), 48–65. https://doi.org/10.1177/1321103X221128733

McPherson, G. E., & Renwick, J. M. (2011). Self-regulation and mastery of musical skills. In B. Zimmerman & D. H. Schunk (Eds.), *Handbook of self-regulation of learning and performance* (pp. 234–248). Routledge. https://doi.org/10.4324/9780203839010

Nayak, A., Satpathy, I., & Jain, V. (2024). The Project-Based Learning Approach (PBL): Enthralling Students Through Project-Based Learning Approach (PBL) in Education 5.0. In A. Sorayyaei Azar, A. Albattat, M. Valeri, & V. Hassan (Eds.), *Advances in Educational Technologies and Instructional Design* (pp. 158–174). IGI Global. https://doi.org/10.4018/979-8-3693-3041-8.ch010

Schmidt, C. (2022). The reflective practices of early and late career music educators. *Research Studies in Music Education*, *44*(1), 110–126. https://doi.org/10.1177/1321103X211016891

Shin, D. D. (2024). Curiosity promotes self-regulated learning and achievement in online courses for students with varying self-efficacy levels. *Educational Psychology*, *44*(4), 455–474. https://doi.org/10.1080/01443410.2024.2372302

Singha, R. & Singha, S. (2024). Application of Experiential, Inquiry-Based, Problem-Based, and Project-Based Learning in Sustainable Education. In C. Goi (Ed.), *Teaching and Learning for a Sustainable Future: Innovative Strategies and Best Practices* (pp. 109–128). IGI Global Scientific Publishing. https://doi.org/10.4018/978-1-6684-9859-0.ch006

Smilde, R. (2021). *Journeys of lifelong learning in music: Perspectives on musicians' identity and professional performance: A reflective handbook*. Eburon Uitgeverij B.V.

Thwe, W. P., & Kálmán, A. (2024). Lifelong Learning in the Educational Setting: A Systematic Literature Review. *The Asia-Pacific Education Researcher*, *33*(2), 407–417. https://doi.org/10.1007/s40299-023-00738-w

Tuuri, K., Vahlo, J., & Koskela, O. (2025). Autonomous Instrumental Music Learning on an Online Platform : How is Study Motivation Related to Engagement and Study Outcomes. *Visions of Research in Music Education*, *47*(1), Article 3. https://digitalcommons.lib.uconn.edu/vrme/vol47/iss1/3/

Verkooijen, M. H. M., Van Tuijl, A. A. C., Calsbeek, H., Fluit, C. R. M. G., & Van Gurp, P. J. (2024). How to evaluate lifelong learning skills of healthcare professionals: A systematic review on content and quality of instruments for measuring lifelong learning. *BMC Medical Education*, *24*(1), 1423. https://doi.org/10.1186/s12909-024-06335-9

Wen, M. (2024). Interactive online classes in music education: The impact of online technologies on the level of creative thinking of students. *Current Psychology*, *43*(15), 13619–13629. https://doi.org/10.1007/s12144-023-05411-5

Zimmerman, B. J. (2000). Attaining self-regulation: A social cognitive perspective. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 13–39). Elsevier. https://doi.org/10.1016/B978-012109890-2/50031-7