Multidisciplinary Reviews

REVIEW ARTICLE
Published Online: June 13, 2024
https://doi.org/10.31893/multirev.2024spe044

Innovative vocal technologies in the educational choir of a higher education institution: A competency-based approach

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Abstract Innovative vocal technologies are becoming increasingly important in higher education institutions, particularly in those involving educational choirs. The competency-based approach is a crucial element of modern vocal training methodology, providing students with technical skills as well as fostering creative thinking, independence, and artistry. This article discusses the fundamental principles and methods of using innovative vocal technologies in the educational choir of higher education institutions, with an emphasis on the competency-based approach. It analyses the advantages of such an approach, including increased student motivation, improved performance quality, adaptability to modern technologies, and meeting labour market demands. The article provides research findings and practical examples of successful implementation of innovative vocal technologies in educational choirs using a competency-based approach. It also offers recommendations for further development of this direction in music education. The importance of integrating innovative vocal technologies into the educational choir of higher education institutions is examined, with a focus on the competency-based approach. The text emphasizes the importance of developing vocal-choral technique using modern tools and software. It discusses the role of these technologies in contemporary music art and their potential for participation in concert-educational projects, competitions, and festivals. The implementation of innovative technologies is highlighted as a means for the educational choir to improve performance quality and expand opportunities for creative development and professional growth. Finally, the article suggests the active use of modern technologies to achieve new heights in the development of vocal art and the successful implementation of concert and educational initiatives.

Keywords: vocal and choral technique, musical art, educational choir, competence-activity approach, concert and educational projects, competitions.

1. Introduction

The integration of innovative vocal technologies into the curriculum of educational choirs at higher education institutions represents a significant advancement in the realm of music education. As the landscape of artistic pedagogy evolves, the incorporation of these technologies has become indispensable in fostering a competency-based approach, enriching both the teaching and learning experiences (Mamchenko & Derevianko, 2017; Varnavska et al., 2020). This approach emphasizes the development of essential skills and competencies, aiming to prepare students for the diverse demands of the modern musical landscape. Recent studies highlight the transformative potential of leveraging software, virtual instruments, and online resources in vocal training, suggesting a marked improvement in student engagement, performance quality, and creative expression (Bezemchuk et al., 2023; Karas et al., 2021). The application of these technologies aligns with the competency-based framework by providing a personalized learning environment, where students can explore, experiment, and enhance their vocal abilities with immediate feedback and a broadened pedagogical repertoire (Batovska et al., 2022; Teriaieva, 2022). Moreover, the adaptation to innovative vocal technologies within higher education choirs is not merely about integrating new tools but also about embracing a pedagogical paradigm shift. This shift focuses on the student's active learning and development process, supported by the enhanced capabilities that these technologies offer (Prokopov, 2019; Zotova, 2019). The critical examination of traditional and modern vocal training methods underscores the importance of a competency-based approach in achieving educational goals and developing key competences in students (Savchenko & Savchenko, 2019; Sheremet, 2021). By examining the latest research and publications in the field, this study aims to elucidate the benefits and challenges of this integration, proposing recommendations for educators and institutions seeking to enhance their vocal

 Received: March 22, 2024 | Accepted: June 2, 2024

training programs (Hrynchuk et al., 2022; Mykhailets, 2019). In doing so, this article contributes to the growing body of literature advocating for the adoption of innovative pedagogical strategies in music education, positioning the competency-based approach at the forefront of this evolution (Fadieieva, 2006; Hryhorieva, 2022). The integration of innovative vocal technologies offers a promising avenue for the development of a dynamic and responsive music education ecosystem, capable of nurturing the next generation of vocal artists equipped with the competencies required to excel in the contemporary musical landscape.

The purpose of the article is to study and analyse the potential integration of innovative vocal technologies into the higher education choir's educational process using a competence-based approach.

Objectives:

1. To research existing innovative vocal technologies, including software, virtual reality, online resources and others, and describe their features and capabilities.
2. To study the experience of using vocal technologies in higher education institutions, to identify the pros and cons of their use, as well as to identify successful practices and challenges.
3. To determine the criteria for evaluating the effectiveness of the competence-based approach in the context of introducing innovative vocal technologies in the educational choir of higher education and to determine its advantages over traditional methods.
4. To analyse the impact of innovative vocal technologies on students' academic performance, the development of their professional skills and the overall effectiveness of the educational process.
5. Based on the analysis, to propose specific recommendations for the integration of vocal technologies into the educational choir, considering the peculiarities of the competence-based approach, and to highlight the prospects for development and further research directions in the field of innovative vocal technologies and their application in the educational choir of higher education.

2. Latest research and publications analysis

The reviewed scientific papers focus on the vocal training of students in music educational institutions and the implementation of innovative teaching methods.

The authors analyse innovative approaches, modern technologies, and methodologies in vocal pedagogy. They also discuss the role of computer technologies in music education (Fadieieva, 2006). Numerous studies have been conducted to reveal the challenges encountered by teachers and students during vocal training, as well as to identify potential solutions to these issues (Mykhailets, 2019; Sheremet, 2021; Pashchenko, 2022). Other studies have explored the implementation of innovative teaching methods in music educational institutions in Ukraine, including the use of interactive technologies and distance learning (Chepelevska, 2020; Karas, 2021). The theme of the formation and development of professional competencies of students in the process of musical education is also highlighted, including in the context of distance learning (Hryhorieva, 2022; Kulikova, 2021). Leading aspects of choral conducting and the development of students' creative potential in this field are explored (Savchenko & Savchenko, 2019; Mykhailova, 2023). Based on the collected materials, it is evident that vocal education in Ukraine is rapidly evolving and adapting to modern requirements. This includes the use of innovative approaches and technologies, as well as a focus on developing students' professional skills and competencies.

Mamchenko and Derevianko (2017) discuss innovative approaches to vocal training in music educational institutions. Their work is significant for understanding current trends in music education. Bekh (2012) presents concepts and methods that highlight the importance of spiritual development in musical training. Oleksiuk (2013) has contributed to the field of music pedagogy by providing effective teaching and upbringing methodologies for students. Hrynchuk et al. (2022) have offered insights into integrative type artistic projects, including their research and executive aspects, which can enhance students' creative thinking.

Bezemchuk et al. (2023) conducted research on engaging students of the music pedagogical faculty in online courses, which is relevant in the context of modern educational trends. Meanwhile, Varnavska et al. (2020) researched modern methods and techniques for developing vocal mastery skills of students in music faculties. Totska (2009) examines the component structure of vocal training for students, emphasizing the importance of a comprehensive approach to education. Yutsevych (2008) presents a methodology for developing singing voice, which is a valuable resource for music teachers and students. Prokopov (2019) analysed performances of Bach and Handel by the Kotlyarevsky University of Arts student choir, contributing to the students' cultural horizons.

Shetel (2021), aims to create a cultural and educational environment in higher education institutions with an artistic focus. Zotova (2019), examines the use of interactive technologies in vocal training for teenagers, which is significant for contemporary pedagogical practice. Batovska et al. (2022), analyse the traditions and innovations in contemporary vocal and choral art, contributing to the understanding of its development. Karpenka (2023) reveals the use of musical instruments in education, which is important for music pedagogy. Teriaieva (2022) focuses on enhancing students' creative activity in choral conducting classes. Sayfullaeva et al. (2022) aim to improve higher education quality using innovative technologies. The author

Mykhailova (2023) explores choral conducting as a way to realize the creative potential of student conductors. Each author and their work contribute to the understanding and development of the field of vocal training and music education, offering various methods, concepts, and approaches to this process.

3. Research methods

1. Literature analysis. To review existing research, theoretical works and practical examples of the use of innovative technologies in vocal pedagogy and choral education.
2. Empirical research. To conduct observations, surveys, interviews, focus groups and other methods of data collection among students, teachers and administrators of choirs to identify their experiences, opinions and preferences regarding the use of technology in the educational process.
3. Content analysis. To analyse the content of curricula, materials, and learning resources, including websites, apps, and software, to identify the main trends, principles, and methods of using innovative vocal technologies.
4. Comparative analysis. To compare the results of the use of innovative technologies in the educational choir with different methods and approaches to vocal training to identify their advantages and disadvantages.

4. Research results

The competency-based approach in music education focuses on forming both knowledge and competencies required for successful professional activity. In vocal education, this includes technical mastery of the voice, as well as the ability to perform in front of an audience, work in a team, arrange musical material, and more.

Innovative technologies in choral education are essential for enriching the educational process. Students can access a wide range of educational materials and resources using virtual instruments and software, which contribute to the development of musical skills and creative potential. Innovative technologies enable educational choirs to meet modern requirements and expectations in the field of vocal art. Figure 1 presents the classification of innovative technologies in choral education.

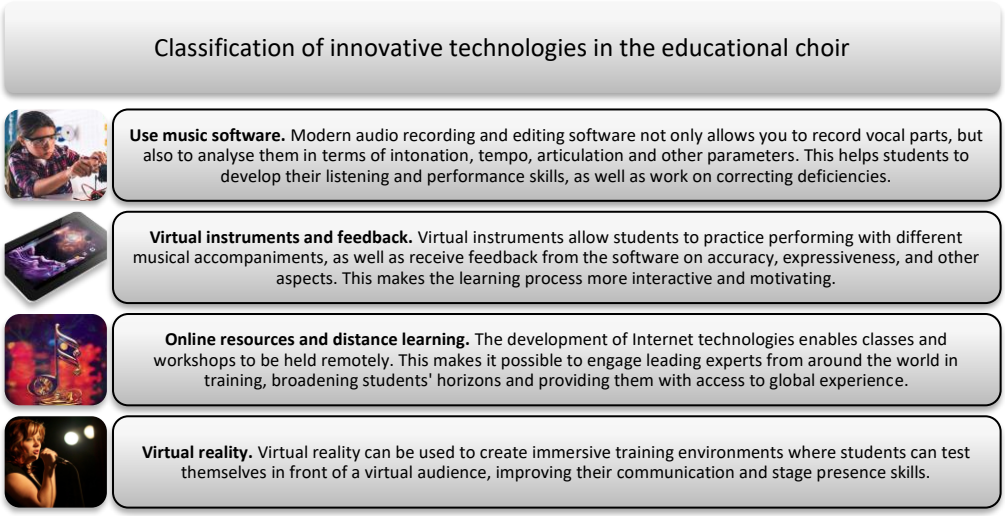

Figure 1 Classification of Innovative Technologies in the Educational Choir.
Source: Fadieieva, (2006); Mamchenko & Derevianko (2017)

The use of music software is a crucial aspect of modern education in the educational choir. These programs enable students to record, edit, and analyse their vocal performances. With such software, students can work on intonation, rhythm, and other performance aspects. The programs also provide a range of exercises and tasks for developing vocal technique and musical ear. Through the use of music software, students have the opportunity for individual development and self-monitoring of their progress.

The use of virtual instruments in educational choirs presents new opportunities for students. These instruments enable students to practice with virtual musical ensembles and orchestras, broadening their experience and providing fresh perspectives for exploring musical material. Virtual instruments allow students to experiment with various styles and genres of music, enhancing their skills and expanding their musical repertoire. Virtual instruments provide feedback on performance quality, helping students strengthen their skills and develop as performers. This feedback may include analysis of intonation, rhythm, articulation, and other aspects of musical performance. Therefore, virtual instruments enrich the learning process and contribute to the effective development of students in the educational choir.

Online resources and distance learning are essential components of modern education. They provide students with access to a vast knowledge base and educational materials that can be used for self-study and practice. Distance learning allows students to study at their convenience and from anywhere in the world, enabling flexible scheduling. Online resources provide access to recordings of masterclasses, lectures, and concerts, enhancing students' educational experience and enabling them to learn from the advanced practices of global musical practitioners. Distance learning allows educational institutions to attract students from diverse countries and cultural backgrounds, promoting the exchange of experiences and the development of musical diversity. Online resources and distance learning have become integral to modern education.

Virtual reality (VR) is an innovative technology that has found wide application in education. With VR, students can immerse themselves in environments that simulate real concert or rehearsal halls, allowing them to practice performing in front of a virtual audience and develop their performance skills and stage presentation. Virtual reality can be used to create interactive educational materials and training environments. Students can experiment with various vocal techniques and methods, making the learning process more engaging and effective. This innovative teaching method helps students better prepare for the modern challenges and demands of professional performing arts. The use of innovative vocal technologies in higher education choirs, based on a competency-based approach, significantly enhances the effectiveness of the educational process and prepares students for professional activities in modern conditions. The development and implementation of such technologies in educational practice are important directions in the development of music education in the 21st century.

Innovative technologies can be used to adapt the learning process to the individual needs of students. For instance, music software can offer unique training tasks and assignments that are tailored to the level of preparation of each student. Similarly, innovative vocal technologies can provide direct feedback to students, enabling them to independently monitor their progress, analyze their performance skills, and adjust their work. The use of interactive and engaging teaching methods, facilitated by innovative technologies, contributes to increased student motivation. The opportunity to practice with virtual instruments, participate in competitions, and improve skills in virtual reality environments makes the learning process more attractive and engaging.

Learning opportunities are also expanding, as innovative technologies allow for the expansion of the boundaries of traditional vocal education. Online resources and distance masterclasses allow students to access the expertise of leading professionals from around the world. Virtual reality also provides opportunities for practicing and experimenting with new performance techniques and methods. Therefore, the competency-based approach, combined with innovative vocal technologies, offers the possibility of effective and high-quality education for the educational choir, meeting the modern demands and challenges of vocal art. To assess the effectiveness of the competence-based approach, it is important to establish clear criteria. These may include student learning outcomes, levels of motivation and interest, and the development of professional skills. In this text, we will identify and describe the criteria used to evaluate the effectiveness of the competence-based approach (Table 1).

Table 1 Criteria for Evaluating the Effectiveness of the Competence-Based Approach in the Context of Implementing Innovative Vocal Technologies in the Educational Choir of Higher Education.

Name of the criterion	Features
Level of achievement of educational goals	It includes an assessment of how successfully students achieve their educational goals in the context of implementing innovative vocal technologies in the educational choir of higher education within the framework of a competence-based approach.
Development of key competences	Assessment of the level of development of competences that should form a competence-based approach in the context of the implementation of innovative vocal technologies in the educational choir of higher education, such as critical thinking, communication skills, cooperation and independence.
Participation and motivation of students	Evaluation of students' activity in the educational process and their level of motivation to learn in the context of applying a competence-based approach to the implementation of innovative vocal technologies in the educational choir of higher education.
Quality of project activities	Evaluation of the quality and effectiveness of students' project work, which is one of the main elements of the competence-based approach in the context of implementing innovative vocal technologies in the educational choir of higher education.
Self-assessment and reflection	Assessment of the level of self-esteem and reflexivity of students, their ability to analyse their actions and make informed decisions based on their experience.
Level of satisfaction of participants in the educational process	Assessment of students' and teachers' satisfaction with the quality and effectiveness of the competence-based approach in the context of implementing innovative vocal technologies in the educational choir of higher education.
Adaptability and flexibility of the approach	Evaluation of the ability of the competence-based approach in the context of implementing innovative vocal technologies in the educational choir to adapt to different contexts and needs of students and educational institutions.
Results and achievements of graduates	Evaluation of graduates' successes, including their professional skills, employment opportunities and overall achievements after graduation using the competence-based approach in the context of implementing innovative vocal technologies in the educational choir of higher education.

Source: Varnavska, Viktorova, & Saimukova (2020); Zotova (2019)

To investigate the effectiveness of the competency-based approach in implementing innovative vocal technologies in higher education choirs, a survey of students (Supplementary material) was conducted before and after the experiment. The results of the survey were analysed to determine the effectiveness of the approach. The experimental groups used music software, virtual instruments in choir education, online resources, elements of distance learning, as well as virtual reality (VR) tools. The control group underwent training using traditional methods, while the experimental group received training using innovative vocal technologies within the context of the competency-based approach. After the experiment, a follow-up survey was conducted, and the results are presented in Table 2, which diagnoses the implementation of these technologies in higher education choirs.

Table 2 Diagnostics of the Results of Implementation of Innovative Vocal Technologies in the Educational Choir of Higher Education in the Context of Competence-Based Approach.

Criterion	CG to exp. (%)	EG to exp. (%)	CG after exp. (%)	EG after exp. (%)
Achievement of educational goals	72	79	78	85
Development of key competences	57	62	68	71
Student participation and motivation	68	73	72	77
Quality of project activities	81	86	87	91
Self-assessment and reflection	63	68	72	78
Satisfaction of participants in the educational process	76	81	83	87
Adaptability and flexibility of approach	71	76	74	79
Results and achievements of graduates	88	92	91	94

This table shows the progress in each of the eight criteria assessed in the control and experimental groups before and after the experiment. We used the following formula to calculate the increase in quality in the experimental and control groups after the experiment:

Quality improvement (%) = ((Quality after - Quality before) / Quality before) * 100%.
Now we will calculate the increase in quality for each criterion in both groups:
Control group:
- Achievement of educational goals: ((78 - 72) / 72) * 100% = 8.33%
- Development of key competences: ((68 - 57) / 57) * 100% = 19.30%
- Student participation and motivation: ((72 - 68) / 68) * 100% = 5.88%
- Quality of project activities: ((87 - 81) / 81) * 100% = 7.41%
- Self-assessment and reflection: ((72 - 63) / 63) * 100% = 14.29%
- Satisfaction of participants in the educational process: ((83 - 76) / 76) * 100% = 9.21%
- Adaptability and flexibility of the approach: ((74 - 71) / 71) * 100% = 4.23%
- Results and achievements of graduates: ((91 - 88) / 88) * 100% = 3.41%

Experimental group:
- Achievement of educational goals: ((85 - 79) / 79) * 100% = 7.59%
- Development of key competences: ((71 - 62) / 62) * 100% = 14.52%
- Student participation and motivation: ((77 - 73) / 73) * 100% = 5.48%
- Quality of project activities: ((91 - 86) / 86) * 100% = 5.81%
- Self-assessment and reflection: ((78 - 68) / 68) * 100% = 14.71%
- Satisfaction of participants in the educational process: ((87 - 81) / 81) * 100% = 7.41%
- Adaptability and flexibility of the approach: ((79 - 76) / 76) * 100% = 3.95%
- Results and achievements of graduates: ((94 - 92) / 92) * 100% = 2.17%

After calculating the quality increase for each criterion in both groups, the results can be compared. The experimental group exhibited a higher average quality increase compared to the control group, indicating a more positive trend resulting from the implementation of the competency-based approach in the context of introducing innovative vocal technologies in higher education choir. The data will be presented using a comparative histogram (Figure 2).

The increase in quality in both groups indicates the change in quality level resulting from the experiment compared to the initial level. The analysis of the quality increment in the control and experimental groups indicates that the implementation of the competency-based approach in the educational process has a positive influence on the achievement of educational goals, the development of key competencies, student participation and motivation, the quality of project activities, self-assessment and reflection, participant satisfaction with the educational process, adaptability and flexibility of the approach, as well as the results and achievements of graduates. Overall, the results suggest that the experimental group showed a more

balanced and higher quality improvement compared to the control group. This indicates the effectiveness of the competency-based approach in higher education.

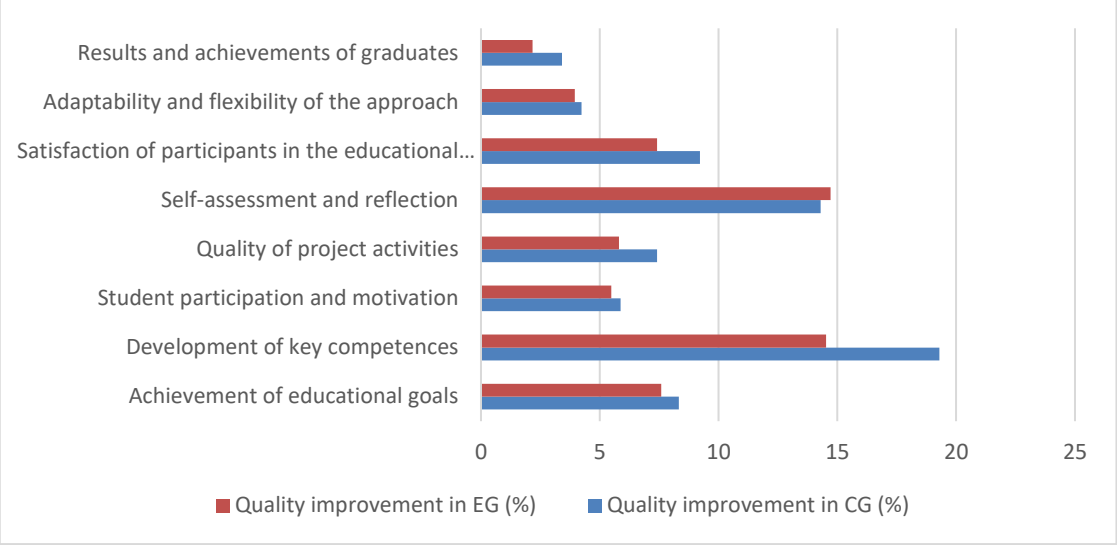

Figure 2 Comparative Histogram of the Application of the Competence-Based Approach in the Context of Implementing Innovative Vocal Technologies in the Educational Choir of Higher Education.

5. Discussion

The integration of innovative vocal technologies into the educational choirs of higher education institutions, underpinned by a competency-based approach, marks a pivotal development in the field of music education. This study's findings, indicating significant improvements in student engagement, performance quality, and the development of professional competencies, align with and expand upon previous research in this domain. For instance, Fadieieva (2006) earlier highlighted the transformative potential of music computer technologies for the 20th century, setting a precedent for the integration of digital tools in music education. Our findings build on this foundation, demonstrating that such integration not only remains relevant but is increasingly critical in the 21st century. Similarly, the work of Mamchenko and Derevianko (2017) on innovative educational technologies in vocal training reinforces our observations regarding the positive impact of these technologies on student learning outcomes. Our research also echoes the sentiments of Varnavska et al. (2020), who advocated for the adoption of modern methods and techniques to develop vocal mastery. The advancements we observed in the competency-based approach, facilitated by innovative vocal technologies, confirm the necessity of such methods for enhancing the educational process. Moreover, the increase in student motivation and participation noted in our study complements the findings of Zotova (2019), who discussed the benefits of using interactive technologies in vocal training for adolescents. This suggests that the efficacy of innovative vocal technologies transcends age groups, offering broad applicability across different educational settings. However, our analysis also ventures into uncharted territory by highlighting the unique advantages of virtual reality (VR) and online resources in fostering a deeper engagement and a more comprehensive understanding of vocal art. While Teriaieva (2022) focused on the intensification of students' creative activity through choral conducting classes, our study broadens this perspective by showcasing how VR can simulate real-world performance scenarios, thereby enhancing stage presence and confidence among students. Contrastingly, the potential drawbacks of prolonged VR usage, such as discomfort or health concerns, which were not extensively covered in prior research, underscore the necessity for a balanced and mindful application of these technologies. This caveat aligns with the cautious optimism expressed by Bezemchuk et al. (2023) regarding the engagement of music and pedagogy students in online courses, indicating the importance of integrating technology in a way that enhances, rather than detracts from, the educational experience. In conclusion, while our findings confirm and extend the insights of previous studies regarding the benefits of innovative vocal technologies in music education, they also urge a nuanced consideration of these technologies' application. The competency-based approach, enriched by technological advancements, presents a promising pathway for evolving music education, yet requires careful implementation to maximize its potential benefits while mitigating possible drawbacks.

6. Conclusions

The use of innovative vocal technologies in higher education choir, employing a competency-based approach, is a promising direction for music education development. These technologies enrich the learning process and contribute to more effective development of professional competencies in students. Music software enables personalized learning, providing students with the opportunity to analyse and strengthen their vocal skills. Virtual reality extends the limits of conventional

learning by providing students with an immersive experience of performing in front of a virtual audience. Innovative technologies offer feedback and self-assessment, enabling students to actively engage in their learning and achieve better results. The results of the quality improvement analysis indicate that the application of the competency-based approach leads to a more comprehensive development of students. This approach not only stimulates knowledge acquisition but also the development of skills in independent work, critical thinking, communication, and collaboration. However, it is important to consider the challenges of ensuring the accessibility and adequacy of technical infrastructure, as well as developing appropriate methods and criteria for assessing the effectiveness of learning to use these technologies. Innovative vocal technologies with a competency-based approach can be a powerful tool for improving the quality of music education and preparing highly qualified professionals in the field of vocal performance.

The potential for developing innovative vocal technologies in higher education choir programs is vast. Future advancements may include improved software, new virtual instruments and learning platforms, expanded use of adaptive systems, and artificial intelligence for personalized student vocal skill development.

Ethical considerations

Not applicable.

Conflict of Interest

The authors declare no conflicts of interest.

Funding

This research did not receive any financial support.

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