BUILDING BRIDGES FOR

DISABILITY-INCLUSIVE MUSIC EDUCATION

IN KENYA THROUGH TECHNOLOGY:

LESSONS FROM THE *JOYINST* LONGITUDINAL STUDY

By

Macharia Kelvin Njoroge

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Supervised by Professor Craig Vear

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ACKNOWLEDGEMENTS

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With much love, I dedicate this work to the remarkable students of SA Joytown Secondary School. It has been a true joy and pleasure to work with each one of you. I hope that *JoyInst* will continue to develop into the tool you have always wished it could be.

INTRODUCTION

In many countries across the globe, music education has remained in a secondary, disadvantaged place in both the school systems and the wider field of education. The disadvantaged position of music education can be well seen when one compares it to the STEM subjects that have historically been considered as the core curriculum. In the case of learners with disabilities, the effects of such marginalisation are, in many cases, more pronounced. Despite the established and extensive international research asserting the cognitive, social, emotional and developmental advantage of music-making, there has been unequal access to quality music education, particularly among developing countries. In Kenya, where educational priorities are often influenced by pressing socio-economic needs, the arts are often put on the back burner, tertiary in the hierarchy of needs, and disabled students are disproportionately affected by this paradigm.

As music and disability are an understudied area, Wangui's (2019) study on the structural and historical barriers that hinder equal access to music education in Kenya is an isolated one. As such, my earlier (2024) dissertation, titled "The Role of Technology in Breaking Access Barriers to Music Education for Physically Disabled Young People in Kenya", was built on Wangui's scholarship, and this longitudinal study is a more extensive follow-up on the previous dissertation. Wangui identified barriers that include factors such as colonial legacies, financial constraints, and deep-rooted ableism. However, this longitudinal study goes beyond diagnosis to investigate a long-term intervention. In particular, it considers the long-term pedagogical and social effects of *JoyInst*, an affordable and accessible digital musical instrument, in alleviating the physical and functional deficits of music-making among disabled students. The previous exploratory case study unveiled the technology and investigated the early adoption of the technology in Kenya, and this gave overwhelmingly positive feedback.[1] However, this follow-up longitudinal study is a step up as it will track student-engagement, musical growth, confidence, and social engagement over a longer period.

The study was conducted in the SA Joytown Secondary School. Joytown is the only special secondary school in Kenya that offers music as an academic subject in the e 8-4-4 education system that is now being outphased by the new Competency-Based Curriculum (CBC). The study is based on a longitudinal design with mixed methods that include stakeholder interviews, a focus group discussion with student participants, pre-intervention and post-

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[1] This longitudinal study is built on the same philosophical and scholarly underpinnings as the previous study.

intervention standardised music assessments, and Likert scale questionnaires administered to student participants at the end of every session. It examines not only the question of whether technology can increase access but also how continuous engagement with available digital instruments influences music identity, music competence, and learner agency over time.

Notably, the research situates music-making as a self-justified human right and not an additional enrichment that only a few (privileged) people should have access to. Through considering *JoyInst* as a pedagogical and socio-technological intervention, the study examines the potential of digital solutions to disrupt the power structures of exclusion that are inherent in the traditional instrumental forms of pedagogy and assessment practices. By so doing, it adds new empirical data to the understudied area of music, disability, and technology in the Kenyan context.

Chapter One presents a comprehensive examination of the state of music education in Kenya. Using a chronological approach that begins in the pre-colonial era, it analyses the structural challenges that have shaped music over time. The discussion identifies challenges inherited from Kenya's colonial past alongside those that have emerged within the nation itself, highlighting how both continue to affect music education, particularly for disabled learners. Chapter Two explores the complex interplay between music and disability. It opens with an international perspective before narrowing its focus to the Kenyan context and incorporates reflective insights drawn from my lived experience. Central to this chapter is a carefully articulated socio-scientific definition and conceptual framing of disability, aligned with the study's progressive objectives.

Building on this foundation, Chapter Three offers an in-depth review of global technological innovations designed to enhance musical accessibility for disabled people. It then concentrates on a specific digital intervention tailored to the Kenyan context, developed in collaboration with the Digital Score Project. The chapter also outlines the theoretical framework informing disability inclusion in music, advancing the view that active music-making constitutes an intrinsic human right. Accordingly, although substantial scholarship underscores the value of music education, this study does not seek to regurgitate those justifications. The final chapter presents a longitudinal case study involving the implementation of the proposed technological solution at SA Joytown Secondary School. The chapter concludes with a discussion of the study's findings, limitations, implications, and recommendations for further research.

It is worth noting early on that due to limited literature, the study inevitably uses some old references in the first two chapters. It was also imperative to employ some primary sources, particularly expert interviews, due to the limited published literature on music and disability in Kenya.

1.1. Chapter Overview

The first chapter of this study begins with a historical retrospective of educational developments in Kenya since independence. It scrutinises music education's status in the nation while spotlighting the systemic challenges. The chapter also examines the application of music technology within Kenyan music education, laying the groundwork for in-depth analyses and insights to be expounded upon in subsequent chapters, and highlights the value of the annual Kenya Music Festival in promoting music education.

1.2. A historical context: pre-colonialism to date

The educational landscape in Kenya, a British colony from 1920 to 1963, has experienced significant transformations since the nation-state gained political independence. Precolonial 'Kenyan' education, like other parts of Africa, was notably incompatible with the Western formal education system introduced to the continent through colonial and missionary work.[2] As Omolewa (2007) observes, indigenous African education primarily manifested as an informal and vocational system tailored to equip members of the community with the skills necessary to play their respective roles in society. Apprenticeship and oral traditions, encompassing narratives, proverbs, and myths, constituted pivotal modalities of instruction within this indigenous educational framework. During colonialism, however, European powers consistently depreciated traditional African educational and cultural practices, supplanting the indigenous forms of knowledge and instructional methods with the imposition of Western formal education.

Given that education inherently harbours a political agenda (Paranjpe, 1995; Samaddar, 2007), scholars contend that the covert agenda of colonial (Western) education was to mould Africans into colonial subjects by depreciating their indigenous pieces of knowledge, which had so far formed a vital aspect of African identity (Mosweunyane, 2013; Fataar, 2018). From the perspective of the colonialists, colonialism, with its constituent institutions of (Western) education and religion, was an effort to 'civilise' the 'uncivilised' peoples of the 'dark

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2 Kenya is used in inverted commas here as it is a colonial construct; that is a consequence of the Berlin Conference, which did not exist as a national consciousness or nation-state until independence. Pre-colonial Kenya was a conglomeration of nations, which are today's ethnic groups (see Griffiths, 1986; Juma, 2012).

continent' (Mlambo, 2006; Masondo, 2018; Nwauwa, 2020). As such, Western education assumed a superior stance, positioning itself as an intellectual ideal that Africans were encouraged to aspire to.

In colonial Kenya, akin to other colonised nations, the educational landscape, reflective of societal structures, was delineated along racial boundaries with distinct educational systems labelled 'African education', 'Asian education', and 'European education', which operated within discrete frameworks demarcated by inflexible boundaries (Ongati, 2015). The racial stratification of education was based on the colonialist ideology positing that the cognitive development of the average African adult was comparable to that of a European child aged seven to eight (Ibid, p.290). The clash between Western and African educational approaches has had notable consequences in post-colonial Kenyan music education. For instance, adapting African folk music for classroom teaching reduces a significant portion of its social-cultural elements (Ongati, 2007). African folk music was not initially formulated for formal classroom instruction but embedded in a complex social-cultural milieu where the performer and the audience play an active role in the music-making experience.

Kenya adopted the British-modelled 7-4-2-3 education system at independence, which faced considerable criticism from politicians and scholars (Ongati, 2015). This system entailed seven years of primary education, four years of lower secondary education (O-level), two years of upper secondary education (A-level), and three years of university education. In terms of music education, music was available to a few privileged schools, primarily those started by the colonial government or missionaries, as they had classically trained teachers and learning resources (Wangui, 2019). The 7-4-2-3's inability to adequately address the educational and workforce requirements of the developing nation, which were key points of concern, prompted the government to institute various commissions to reform it. Notable among these commissions were the Ominde Commission (1964) and the Gachathi Commission (1976), whose efforts culminated in the Mackay Commission's (1981) recommendation for a new national education system, known as the 8-4-4, which was inaugurated in 1985. The 8-4-4 entailed eight years of primary school (Standard 1 to 8), four years of secondary education (Forms 1 to 4) and four years of (undergraduate) university education.

Upon the inception of the 8-4-4 system, music was compulsory in primary schools and elective at the secondary level. Making music an examinable subject caused implementation challenges, such as the inadequacy of staff and teaching and learning resources, as this was

previously an extracurricular activity in most schools (Wangui, 2019). However, a pivotal shift occurred in 2002 when a review was initiated to address concerns about curriculum overload due to many compulsory subjects, causing congestion and burdening students, parents, and teachers, as well as a financial burden to the government. This resulted in music being rendered non-examinable at the primary level but optional and examinable in a select few high-ranking public secondary schools (primarily national and a few extra-county schools) and the private schools that could afford it.[3]

The 2002 review forms the genesis of many music education challenges experienced in Kenya today, which have more significant implications on special needs music education, as will be evident in the next chapter. Since the 8-4-4 system is exam-oriented in nature, there is an emphasis on performance in the annual national exams, namely the Kenya Certificate of Primary Education (KCPE) and the Kenya Certificate of Secondary Education (KCSE) (Milligan, 2017; Ongati, 2015; Wanyama, 2006). Since music was made non-examinable in primary schools, teachers and pupils undervalued it, and lessons allocated for it were utilised to teach other examinable subjects like English and Mathematics to meet the performance pressure. Reducing two years of secondary education also meant that teachers and students had a shorter time to cover a consolidated secondary syllabus (Kaviti, 2018). The lack of exposure to music during primary education contributes to a lack of interest among students in pursuing the subject at the secondary level, as highlighted by Wanyama (2006), resulting in a consistently small number of KCSE music candidates over the years, as indicated by the Kenya National Examinations Council reports (2014; 2018).

Furthermore, in secondary schools, there is a tendency for curriculum developers to disproportionately emphasise a limited set of examinable skills, such as notation and singing, neglecting the holistic musical development of learners (Wanyama, 2006; Ongati, 2015; Mochere, 2016a). Consequently, teachers adopt an equally narrow approach, primarily concentrating on the few skills that hold examination value. This results in what Ongati (2015, p.306) terms learners who are "not grounded in music concepts" and hence "cannot behave musically" (Mochere, 2016a, p. 54). This phenomenon has a ripple effect at the tertiary levels (colleges and universities), thus negatively affecting the competence of music teachers, as Wanyama (2006) notes.

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3 Public secondary schools are ranked as sub-county, county, extra-county and national. Admission to these schools is purely based on academic merit, and most of the national schools are often better resourced, founded in the colonial era and subsequently inherited by the government.

Another critical challenge in 8-4-4 is the curriculum's overemphasis on Western classical music despite most students expressing a greater interest in contemporary African and popular global music (Mochere, 2016a; Mochere, 2016b). The mismatch between the curriculum focus and students' musical preferences leads to a demotivating situation, as students choose to study music expecting to engage with the music of their interest. As such, the classroom practices, a consequence of curriculum requirements inherited from the British-modelled education system, are delinked from the musical experiences and expectations of the students.

The critique of the 8-4-4 education system, as highlighted by scholars such as Milligan (2017), underscores the challenges arising from an overemphasis on content at the expense of holistic skill development. Critiques advocated for a reconsideration of the 8-4-4 to better align with the evolving needs of students and the demands of the 'real world'. As the discourse surrounding educational reform gained momentum, it became imperative for the government to address the identified shortcomings and explore alternative approaches that foster a more balanced integration of content and skill acquisition, hence the 2017 Competency-Based Curriculum (CBC). Mirroring previous educational reforms, the CBC resulted from the recommendations of the 2012 Odhiambo Taskforce (Muricho, 2023). However, the ongoing implementation of CBC has encountered notable challenges that have impeded its effectiveness. Such impediments include deficiencies in the assessment strategy, insufficient funding, discord regarding the placement of junior secondary schools, shortages in teaching staff, inadequate teaching and learning facilities, and apprehensions expressed by parents (Ibid.).

It is imperative to acknowledge that educational reforms in Kenya possess a political dimension (Imana, 2020). As such, Amutabi (2003) asserts that the ideas propagated by politicians, even when lacking depth and foresight from a scholarly perspective, are accorded a privileged status, thus underplaying the contributions of professionals (teachers and educationists). Within the specific context of the CBC, a consequential political development transpired after President Ruto assumed office in September 2022. About two weeks later, the President exercised his executive prerogative by appointing members to the Presidential Working Party on Education Reforms (Muchira, Morris, Wawire, and Oh, 2023).

President Ruto's campaign rhetoric included critiques of the CBC, characterising the new system as the legacy project of former President Kenyatta. In alignment with his campaign promises, President Ruto, upon assuming office, mandated the task force to proffer

recommendations to effect substantive changes in the CBC educational framework. Owidi and Lyanda (2023) further note that the teachers' input is not given due consideration during the development of the education system, as was the case in the CBC, where teacher input was most prominent in implementation. As a later chapter will indicate, this political dimension of Kenyan education necessitates political goodwill from the political class, policymakers in the Ministry of Education and curriculum developers to promote lasting positive change for special needs music education.

Given the constant changes in the CBC system and that its implementation just extended to the (senior) secondary level in January 2026, a fair, comprehensive evaluation of CBC music becomes challenging. Additionally, despite the incorporation of music into all levels of the CBC, the subject is only seriously taught in senior secondary school. For these reasons, this study will examine secondary music within the context of the 8-4-4 system. The implications of this study are, however, very much relevant to the ongoing implementation of the CBC in (senior) secondary schools. The figure below summarises major education reforms in Kenya since independence.
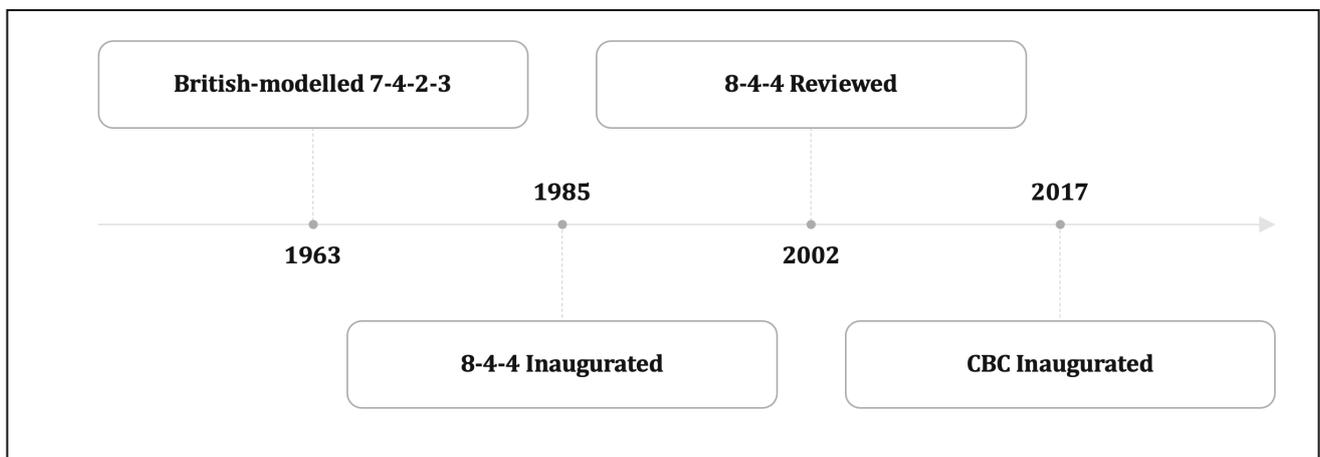

Figure 1

1.3. KCSE Music

Small (1998, cited in Dell'Antonio, 1999) characterises 'musicking' as an all-encompassing activity entailing performance, composition, listening and dancing to music. According to Monte and Mochere (2019), the Kenyan secondary music curriculum, which prescribes the content covered in various levels of education, provides a limited level of musicking. As such, it leans heavily towards the Western classical tradition, involving an instructional approach where students learn and perform pieces by Western composers, memorise Italian technical terms, learn technical exercises to enhance performance skills and partake in sight reading as an integral aspect of developing musical proficiency. This approach also benefits from well-defined assessment criteria established over years of practical implementation. Given that 8-4-4 is exam-oriented, as discussed earlier in this chapter, examining the content covered in the KCSE exam would offer an insight into what teachers and students typically emphasise most.

The Kenya National Examinations Council (KNEC), the national examinations body, assesses music through a tripartite examination format comprising practicals, aurals, and theory, reflective of the content covered in secondary music textbooks. The tables below summarise areas tested (and taught) in KCSE. It is worth noting that this summary is based on the KCSE 2023 examination. While some areas tested in the 'general music knowledge' section change yearly, the remaining sections and the two other tests are representative of a standard KCSE exam (source: KCSE Music Exams, 2010-2023).

Paper 1: Practical Test (50 marks)

SECTION	AREAS ASSESSED	TOTAL MARKS AWARDED
Technical Exercises	- Scales - Arpeggios - Sequences	10 marks
Sight Singing/Sight Reading	Reading pitch, rhythm and performance directions	10 marks
Set Western Piece	Singing/playing a Western set piece	15 marks
African folk song/ African folk dance	Singing/playing an African folk song or dance of the student's choice	15 marks

Table 1.

Paper 2: Aural Test (50 marks)

SECTION	AREAS ASSESSED	TOTAL MARKS AWARDED
Rhythm	- Drum rhythm - Rhythm of a melody in simple time	20 marks
Melody	- Melody in major key - Melody in minor key	20 marks
Intervals	Identifying two intervals played	2 marks
Cadences	Describing the cadence played is perfect, imperfect or plagal	4 marks
Modulation	Identifying whether the melody modulates to the relative minor, relative major, dominant or subdominant	2 marks

Table 2.

Paper 3: Music Theory (100 marks)

SECTION	AREAS ASSESSED	TOTAL MARKS AWARDED
Basic Skills	- Completing a 16-bar melody with a given opening - Composing a melody to given text - Harmonising a given melody for SATB choir	30 marks
History and Analysis	- African music - Western prescribed composers - Analysis of prescribed African music - Analysis of prescribed Western music - Analysis of unprepared work	54 marks
General Music Knowledge	General questions about Western and African music	16 marks

Table 3.

1.4. Technology in Music Education

Apart from the challenges highlighted earlier, the underutilisation of technology in Kenyan schools is a noteworthy challenge (Amuko, Miheso and Ndeuthi, 2015; Awuor and Okono, 2022). As such, scholars such as Tondeur, Krug, Bill et al. (2015) have advocated for the employment of technology as an intervention to enhance learning outcomes in various school subjects. In music education, most classrooms, especially in government-funded schools, use limited technology, such as radios and cassettes (Mochere, 2014). The lack of such technology as computers and electronic keyboards impels classroom teachers to employ ineffective methods that do not benefit the students, such as using the lecture method in practical topics like melody writing (Mochere, 2016; Ongati, 2015). The employment of such methods results in students' inability to understand the technical topics, hence resentment (Mochere, 2016) and poor performance in such practical areas nationally, as the national exams reports indicate (see KNEC, 2018; 2014). Despite the extensive advocacy of music educators and scholars, school principals are hesitant to fund the installation of music technology, chiefly due to the high expenses associated with such endeavours and limited school budgets (Wanyama, 2006). Similarly, it is worth noting that the entire national music examination is handwritten, resulting in notable difficulties for learners with various physical dexterity challenges, as the following chapters will reveal.

Yeşilel (2016) underscores the need for twenty-first-century education to embrace technology, characterising it as the native language of the twenty-first-century learner. The importance of technology in twenty-first-century education is also emphasised by other scholars (see Yoo, 2022; Henriksen, Mishra and Fisser, 2016; Crawford, 2013). In the Kenyan context, scholars such as Masingila, Khatete, Maundu et al. (2019) and Odera (2011) assert that using technology in the classroom has notable contributions towards student motivation. As scholars like Nart (2016) and Portowitz, Peppler and Downton (2014) note, the employment of technologies such as notation software and electronic keyboards extends the repertoire of methods available to teach practical skills such as melody writing, harmony and performance, and Monte (2009) similarly asserts its positive impact on learning outcomes in practical areas in the Kenyan context. Thus, technology contributes to solving the issue of the negative attitudes towards practical areas that were highlighted earlier.

Despite the underutilisation of technology in music education, one should note that the government of Kenya has made notable strides towards the integration of e-learning (laptops and tablets) in primary schools since 2017 in a bid to meet the demands of twenty-first-

century education (see Njeru, 2019; Heinrich, Darling-Aduana and Martin, 2020). The underutilisation of technology in the Kenyan music classroom is of central importance to this study as it examines the role of digital musical instruments in promoting the accessibility of music by physically disabled secondary school music students, an area with limited scholarly attention in Kenya. Given its heavy emphasis on twenty-first century skills like collaboration, inclsion and digital literacy skills (see Opicho, Imonje and Chepkonga, 2025; Kingi, 2025), the CBC is expected to bridge this gap of technology integration in teaching and learning. However, the availability of the requisite infrastructure, especially in rural areas, and teacher preparation still remain a challenge that can hinder the proper realisation of the aims of the CBC as far as technology is concerned (Cheruiyot, 2024).

1.5. The Kenya Music Festival

While music is not available as a subject in primary and most secondary schools in the country, the annual Kenya Music Festival (KMF) competitions present an avenue for musical engagement for learners of all levels, from pre-primary to tertiary (Akuno, 2012; Ongati, 2015). As an institution, the festival was started in the colonial era to appreciate and sustain the performance of indigenous music. It was affiliated with the British Federation of Music Festivals until 1990 (Kidula, 1996). Today, the Ministry of Education organises the festival as a co-curricular activity, and it is divided into various categories with sensitivity to ensemble type and genre. Such (broad) categories include African, Eastern and Western singing, solo and group instrumental performances, elocution, African and Western dances and various types of choral performances. Akuno (2012) further observes that the rigorous preparation needed to participate in the competition successfully is akin to classroom teaching.

> *The selection, creation and teaching of music for these activities require a high level of proficiency in music for the teacher who aspires to succeed and to give pupils a worthwhile experience. The expectations are no less significant than those for classroom music teaching, requiring musicianship and ability to transfer knowledge.*[4]
>
> Akuno (2012, p.274-275)

Thus, KMF is as important as the classroom experience in Kenyan music education, and it is therefore imperative to acknowledge its central role while discussing music education in the country, albeit in passing, as the primary focus of this study is the classroom music-making experience. For more recent scholarship on KMF, see Akuno (2016), Masasabi (2018), and Andang'o (2019).

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[4] Italics mine

1.6. Chapter Summary

This chapter has elucidated the low-regarded state of music education in Kenya while highlighting key educational developments since the pre-independence era. The low regard for music education is evidenced by and a consequence of the 2002 curriculum review, which relegated music to a privilege for those who can afford it: few high-ranked secondary schools and private schools. Music is generally underfunded and undervalued by head teachers and parents. The chapter also noted the underutilisation of technology in the Kenyan music classroom, which will be a central discussion later, and the critical role of KMF in Kenyan music education.

MUSIC AND DISABILITY

2.1. Chapter Overview

Commencing with the conceptualisation and definition of disability, this chapter lays the foundation for understanding its multifaceted nature. Subsequently, it delves into the definitions of inclusion and access, recognising them as fundamental components of the disability experience. The discussion extends to the global landscape of disability-inclusive education before focusing on disability inclusion within music education, with a particular emphasis on Kenya. Persistent challenges are identified throughout this exploration, setting the stage for a more in-depth examination in subsequent chapters.

2.2. Definition and Conceptualisation of Disability

While disability can be a complex term to define and conceptualise, modern disability discourse focuses on two major models, namely the medical and social models of disability (Manago, Davis, and Goar, 2017). The medical model views disability solely as a medical diagnosis. As such, its proponents often identify as persons '(living) with a disability'. On the other hand, the social model posits that people experience disability as a result of impediments imposed by an unaccommodating (ableist) societal framework. Exponents of this view often identify as 'disabled' (sometimes capitalised)—disabled by the societal barriers obstructing their participation in society as opposed to the medical diagnosis.

While disability is undoubtedly a medical issue, viewing it as a consequence of an unaccommodating society is both constructive and progressive (Hogan, 2019). The social model is "the primary vehicle for activism" (Manago, Davis, and Goar, 2017, p.176), demonstrating its progressive nature and refuting any suggestion that it intends to promote feelings of disempowerment or victimhood within the disabled community. However, it would be imperative to acknowledge that neither of these opposing models fully encapsulates the entirety of the disability experience. While the social model is effective in activism, the medical model is often used in challenging disability-related stigma. For instance, parents or guardians can use medical diagnosis to censor critical comments directed to their disabled children, such as those with behavioural challenges caused by autism (Ibid.). As such, the two models are often mutually inclusive in practice.

The discourse arising from the two opposing models of disability raises fundamental questions in social science concerning the relationship between the individual and the structural, and the biological and the social (Shakespeare, 2004). Further, there are numerous political and scholarly debates concerning the correct terminology to describe disability (Darrow, 2015; Oduor, 2022). Such debates are inclined to reduce biases, with the acknowledgement that language influences perception and impacts the individual or minority group described. The evidence supporting this assertion is visible even in early literature, where psychologist Wright (1960) posits that the language employed to describe people with disabilities can either be derogatory or empowering.

Wright's premise has underpinned the advocacy for non-discriminatory language in disability discourse, spearheaded by organisations such as The World Institute on Disability and the National Organization on Disability, among others. The 'person first' model is often preferred as it demonstrates that the individual possesses many traits, one of which may be a disability (Andrews and Forber-Pratt, 2022). In some instances, euphemistic terms such as 'differently abled', 'handicapable', and 'physically challenged' have been used to describe disability in an attempt to be less offensive (Forber-Pratt, Mueller and Andrews et al., 2019; Andrews and Forber-Pratt, 2022). However, such euphemism can be a minimisation of the barriers faced by disabled people (Andrews and Forber-Pratt, 2022) and, consequently, the role that society plays in creating and breaking these barriers.

Some modern scholars view disability as an element of human diversity akin to other markers of diversity, such as gender and race (Andrews and Forber-Pratt, 2022; Darling, 2013). The phrase "temporarily able-bodied" is used to characterise non-disabled people based on the assumption that most people will become disabled at some point in their lives, if only as a result of ageing (Darrow, 2015). As such, disability is likely the only minority group to which any person can be involuntarily admitted at some point in their life. It is also important to acknowledge the complex discourse on disability identity politics, including the notion of disability pride, in modern disability studies (Bogart, Lund and Rottenstein, 2018; Forber-Pratt, Mueller and Andrews, 2019; Zapata, 2019).

In terms of definition, Grut, Olenja and Ingstad (2011) characterise disability as an occurrence when an individual's capacity to perform daily tasks, engage in local and community activities, and fulfil societal roles that are deemed normal by both the individual and the community is restricted or impeded due to environmental obstacles that fail to accommodate the

individual's physical, sensory, mental, and/or cognitive impairments/differences. Pettinicchio and Maroto (2021) note that governments often define disability in a narrow (medical) way to minimise the number of disabled people entitled to receive disability-related state benefits. The Kenya Disability Resource, for instance, defines disability as "any condition of the body or mind (impairment) that makes it more difficult for the person with the condition to do certain activities (activity limitation) and interact with the world around them (participation restrictions)." In line with this definition of disability, 0.9 million people of the 47,564,300 total population (2.2%) in Kenya live with some form of disability, according to the Kenya National Bureau of Statistics 2019 National Census (Development Initiatives, 2020). This study adapts Grut, Olenja and Ingstad's (2011) definition as it is comprehensive and consistent with the social model of disability on which this study is premised. Similarly, the term 'disabled' is used in this study in line with the social model of disability.

2.3. Inclusion

Like disability, inclusion has been challenging to define and conceptualise (Schuelka, 2018; Waitoller and Artiles, 2013). As Berlach and Chambers (2011) note, the lack of a tight conceptual focus risks simplistic broad understandings, hence misconceptions and haphazard practices. Such broadness also renders the term susceptible to being classified as ephemera. In the educational milieu, there are four broad perspectives to view inclusive education, namely special education and disability studies, multiculturalism and anti-racist education, gender and women's education, and queer studies (DeLuca, 2013). In special needs education, Nordlund (2006) characterises inclusion as the continuous integration of disabled learners into the mainstream classroom with suitable support staff to ensure they can access educational services on the same terms as their peers. Other authoritative definitions come from United Nations agencies and conventions, like the Incheon Declaration and the Convention on the Rights of Persons with Disabilities (Schuelka, 2018, p.3). According to the Committee on the Rights of Persons with Disabilities, inclusive education:

a) is a basic right for all

b) entails respect for the welfare, dignity, independence, and societal contribution of students

c) entails the ongoing removal of obstacles that impede access to education by advocating for reforms in school ethos, policies, and practice to accommodate all students

As Grut, Olenja and Ingested (2011) note, exclusion, the antithesis of inclusion, is not necessarily intentional but an inevitable consequence of overlooking people's different functional abilities when developing services intended to be used by everyone.

2.4. Accessibility

Another important term to define here is accessibility, closely tied to inclusion. While there are varying scholarly definitions of the term (Church and Marston, 2003), the American Office for Civil Rights' definition is perhaps the most comprehensive and, thus, most suitable for this study. It characterises accessibility as the occurrence when a disabled person obtains the same information, participates in the same interactions, and benefits from the same services as a non-disabled person in an equally effective and non-discriminatory manner, with considerably comparable ease of use (cited in Burgstahler, 2015). Therefore, accessibility ensures that disabled people can obtain necessary services as comprehensively, equally, and independently as non-disabled people. While ease of use may not be necessarily identical to that of non-disabled people or guaranteed, accessibility provides for equitable treatment.

Accessibility is closely tied to universal design (Iwarsson and Ståhl, 2003). The UN Convention on the Rights of Persons with Disabilities, ratified in Kenya in 2008, advocates for the elimination of disabling barriers through reasonable accommodations and universal design principles (Oduor, 2022). Universal design entails developing infrastructure that disabled and non-disabled people can use, thus eliminating the need for reasonable adjustments. As King-Sears (2014) notes, this forms the fundamental principles of the Universal Design For Learning (UDL) framework used in education. The UDL framework allows educators to present content flexibly and reduce disabling barriers in instruction by providing reasonable accommodations while maintaining high-performance expectations for all learners, despite learners' disabilities. This concept will be important in the next chapter as a critical consideration in developing the digital instrument (*JoyInst*).

2.5. Disability in Education

As a component of diversity, disability is often overlooked in education, unlike other factors like race, gender and sexual orientation (Laes and Westerlund, 2018). Darrow (2015) argues that a significant step toward eradicating ableism and advancing the identity of people with disabilities would be the continuous inclusion of disability as a form of diversity. However, this is often not the case in Kenya and elsewhere around the world. In the United States of America, for instance, Darrow (2015) records an extensive history of exclusion, where public

schools only taught 20% of disabled children until the 1970s. Reasons for such exclusion included the lack of proper facilities in public schools, and school administrators would often double the price of education for disabled learners. In the American context, disability inclusion in schools resulted from the racial desegregation of schools in the 1960s. Pioneering inclusion advocates in schools argued that since the country had banned racial segregation in schools, it was imperative to outlaw discrimination based on disability. Consequently, on behalf of students with disabilities, laws such as The Individuals with Disabilities Education Act (IDEA, 2004), renamed from the 1975 Education for All Handicapped Children Act, were passed. This law guaranteed all disabled children a free, appropriate public education (FAPE). The 1980s saw increased advocacy work to integrate education, thus breaking the general and special education dichotomy.

Accessibility to education among disabled people remains a notable challenge in Kenya (Grut, Olenja and Ingstad, 2011; Barbareschi, Carew, Johnson, et al., 2021). Notwithstanding the growing number of special needs educators, the figures are insignificant compared to the high demand. Many educators in regular schools lack training in handling disabled learners, and they are often left to the mercy of the goodwill of other pupils. Disabled pupils who attend local schools without inclusion measures end up learning few valuable skills. Similarly, only a few schools have accessible classrooms. Disabled girls in crowded (slum) urban areas are also vulnerable to sexual abuse, resulting in early pregnancies and the contraction of HIV/AIDS. This is consistent with a point made by Darrow (2015) that disability is only one of the several characteristics that make a disabled person vulnerable. Andolo (2006) observes that the Kenyan community generally misunderstands disabled people and, hence, is unable to accept and support them to participate in society fully. As such, stigmatisation, mistreatment, and the fear thereof cause some families to 'hide' disabled people in the house to limit their interaction with the world (Grut, Olenja and Ingstad, 2011; Bunning, Gona, Newton, and Hartley, 2017; Barbareschi, Carew, Johnson, et al., 2021). These occurrences are more pronounced among low-income families in rural areas.

Grut, Olenja and Ingstad (2011) further note that the cost of educating disabled children is higher than that of their non-disabled counterparts, as regular schools may not be willing to admit profoundly disabled people. Disabled people from low-income families often rely on sponsors, as social security systems are often unreliable, leaving the family to bear all the costs. Consequently, economically disadvantaged parents often tend to prioritise sending their non-disabled children to school ahead of their disabled counterparts. The over-dependence on

donors forces disabled people to drop out of school when donors withdraw sponsorship. The inaccessibility to education among disabled people, more so girls, results in poverty in adulthood, hence perpetuating the vicious cycle (Wangui, 2019). However, one should note that such challenges are not unique to Kenya. As Grut, Olenja and Ingstad (2011) note, disabled people in both developed and developing countries generally have lower living conditions than their non-disabled counterparts. More recent studies show that the link between disability and poverty is still a problem in Kenya, with about 67% of disabled people living in poverty as of 2018 (Kabare, 2018; Kabia, Mbau, Muraya, et al., 2018; Hunt, Laurenzi, Skeen, et al., 2021), as compared to 38.6% of the general Kenyan population living in poverty (Kenya National Bureau of Statistics, 2023). The anecdote below provides personal experience on the intersection of disability, poverty, music and education.

During my time as a student at Joytown Primary School, a special school for physically disabled pupils, addressing the issue of stigma and poverty was of key concern to our teachers. We were encouraged to use our education and experiences to realise self-reliance and to educate society on the importance of education in confronting the rife disability-equals-begging narrative. This is well captured in the chorus for the 'Ulemavu' (Disability) song recorded in the second volume of the school choir, and one which we performed to school visitors and on most occasions when we were invited to perform, including at Statehouse, Nairobi. The song was featured several times in the closing credits on the *Abled Differently* programme broadcast on Sundays by the Kenya Broadcasting Corporation television (see Ndavula and Lidubwi, 2016 for commentary on this programme). The mentorship and performing opportunities helped me feel empowered, regaining my self-confidence after some challenging experiences in my previous regular school education. The English translation of the original Swahili lyrics below is quoted from the song video.

Do not wait
Till you find the disabled in the streets
With tins begging for coins
You'd rather take then to school
So that they will finally be independent

Source: Grantham Rotary-Club (2016, 01:08–07:43) Joytown Choir.avi. Available at: https://www.youtube.com/watch?v=WC4IX4knEW0&t=238s (accessed 18 February 2024).

2.6. Special Needs Music Education in Kenya

Special needs music education is an under-researched area in Africa. In Kenya, an isolated study was conducted by Wangui (2019). While the study primarily focused on the challenges experienced by learners with cerebral palsy, it has far-reaching implications for those with other physical disabilities. Wangui focuses on the case study of SA Joytown Secondary School since it is the only secondary school for physically disabled learners offering music as a subject in the 8-4-4 system. In a study investigating the psychological problems that physically disabled students at the same school experience, King'uru (2010) observes that disabled students whose disability limits their ability to perform heavy tasks prefer 'lighter subjects' like music and fine arts, as these have less physically demanding activities, avoiding agriculture and home science. This might explain why disabled learners at Joytown show more interest in music than their non-disabled counterparts in the same school at Form 1 (Wangui, 2019).

Wangui observes that learners with cerebral palsy (CP) showed considerable interest in Music in Form 1. However, this declined as they entered Form 2, where they had to choose between music and other art subjects. The general challenges responsible for declining interest included the lack of a primary school music foundation, highlighted in the previous chapter. In the case of Joytown, 77.1 % of the participants had no prior musical training. Other challenges include the complex subject content, a broad syllabus with limited time for teaching and learning music, and negative attitudes towards pursuing music by teachers, parents, and peers. To this end, Wangui recommends making music mandatory and examinable in primary school, adapting the music syllabus to cater for the needs of learners with CP and sensitising parents, teachers and learners on the benefits of music education, particularly to students with CP.

The challenges had considerable adverse effects on disabled learners' career choices, with 60.4% of the participants indicating that they changed their initial career choice after dropping music. While most learners dropped music because of the challenges, most indicated they would continue learning it (and make a career from it) if the challenges were addressed. Although the school offers various subjects, the unaccommodating curriculum prevents students from accessing music due to the barriers discussed (Wangui, 2019). As such, the mere availability of music as a subject does not guarantee its accessibility to disabled learners. The study recommends the following interventions specific to Joytown, and this study hopes to contribute to intervention 'b' with some potential implications on 'c' and 'd'.

a) Adapting the music curriculum

b) A different approach to testing practical areas of music

c) Separating the areas tested in practical exams and making them optional

d) Adapting writing materials to accommodate learners' differences

e) Making the music room more accessible[5]

Another important observation from Wangui (2019) is the lack of specialised training for special needs (SN) music educators. In this regard, Omari (2019) observes that potential SN music teachers are trained in regular universities and colleges, which do not offer specialised training in SN music education. On the other hand, the Kenya Institute of Special Education, established in 1986 to provide specialised training in SN education for teachers and other human resource officers in SN education (Kiru, 2019), does not offer music education (Omari, 2019). Hence, teachers in special schools have to innovate solutions on their own with limited support, given that only one school offers music to disabled secondary students in the country.

Despite limited literature, studies show that other forms of disabilities experience similar challenges in Kenya. For instance, Omari (2019) observes that while deaf learners have the potential to study music as a subject, as evidenced by their successful participation in KMF, they are excluded from studying music as the assessment method is ableist. The aural examination, for instance, is recorded on cassette in audio format, denying deaf learners the opportunity to study music, unlike their blind and physically disabled counterparts. As such, KCSE music is designed for learners with hearing ability and is thus exclusive.

While Kenyan law prohibits discrimination based on disability and gives legal entitlement to reasonable accommodations in the workplace (Ebuenyi, Regeer, Nthenge et al., 2019; Genga and du Plessis, 2022) and education settings (Chomba, Mukuria, Kariuki et al., 2014; Elder, 2015; Moyi, 2019),[6] it is worth noting that the country currently lacks a comprehensive inclusion policy for music education akin to the United Kingdom's National Music Plan that has actionable points on how to make the music classroom inclusive for disabled people (see HR Government, 2022).[7] However, the object of this study is not to compare the UK and Kenya,

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5 The school acquired an accessible music room in February 2024.

6 Exam extensions, for instance, are granted based on medical assessment of need.

7 In a March 2024 interview, Wangui notes that CBC has adapted the secondary music curriculum for disabled learners, though this has yet to be implemented. She further notes that specialised teacher training is needed to implement the policy effectively. In 8-4-4, no documented changes have been made.

as the National Music Plan has been problematised by scholars such as Bacchi (2023), and the mere existence of policy does not necessarily guarantee implementation (Moyi, 2019).

2.7. Chapter Summary

This chapter has defined disability as a social construction and elucidated the importance of inclusion and accessibility in challenging ableism. It further discussed the inaccessibility of education among disabled people in Kenya, which contributes to the cycle of poverty among disabled people. While there is limited literature, the chapter also highlights some of the barriers that disabled secondary school students experience in music education in Kenya. The next chapter will explore the use of digital instruments as an intervention for the barriers highlighted.

CHAPTER THREE

INCLUSIVE MUSIC PRACTICE: A LITERATURE REVIEW

3.1. Chapter Overview

Building on the first two chapters, the third chapter of this study provides a comprehensive background into the field of inclusive music practice, elucidating key terminology employed within the field along with its underlying theoretical framework. An extensive review of diverse digital music instruments ensues, culminating in a focused examination of a single digital instrument developed for the case of Kenya.

3.2. Definitions and Background

To enhance contextual comprehension and ensure conceptual clarity, this chapter will commence by providing precise definitions of several pertinent terms. First, 'inclusive music' refers to the use of music interfaces to overcome barriers that disabled people experience in their pursuit of music-making (Frid, 2019). On the other hand, 'adapted (or adaptive) music' entails developing and implementing adjustments that enable disabled people to participate fully in music-making. 'Adaptive music' also refers to the use of digital technologies (digital musical instruments) to facilitate independent music-making for people who are otherwise unable to play a traditional instrument due to various limitations caused by disabilities (Ibid.).

Adaptive music, as a component of inclusive music practice, is predicated on the premise that the act of making music is a human activity that is fully justified by its own praxis; that is, the mere engagement in it, consequently positing that music is a fundamental human right (Knox, 2004; Bell, Bonin, Pethrick et al., 2020; Grond, Shikako-Thomas and Lewis, 2020). Therefore, although extensive scholarship (see, for instance, Goble, 2010; Pitts, 2017; Swart, 2020) and the earlier anecdote show the value of music, this study will not be concerned with presenting these justifications. Further, Lubet (2011, p.57-8) characterises music as a "canary in the coal mine", elucidating a society's inclusive praxis or the lack thereof. As such, a musically inclusive society is inclusive overall and vice versa.

Until the 1980s, musical inclusion efforts focused primarily on mechanical alterations of existing acoustic instruments (Frid, 2019). The pioneering efforts of including disabled people in music-making can be traced back to Harold Rhode's electric piano, developed for use in hospital bed trays by World War II patients. However, the emergence of MIDI (Musical Instrument Digital Interface), microcomputing technologies, and software and hardware

advancements corresponded with advancing rehabilitation engineering, leading to increased development of various controllers and music technology applications. Today, assistive music technology, accessible digital musical instruments (ADMIs), and commercial adapted instruments for disabled people keep growing and diversifying (Dickens, Greenhalgh and Koleva, 2018; Davanzo and Avanzini, 2020). The advancement of open-source technologies and cheap do-it-yourself components has also simplified the customisation of digital musical tools and increased their accessibility to the general population (Wright and Dooley, 2019).

According to a study conducted in the UK by Youth Music (2020), disabled musicians cite the structure of graded examinations as a primary obstacle to their engagement in music-making. These assessments require musicians, regardless of disability, to conform to (exclusive, ableist) standards designed by and for non-disabled musicians when playing traditional instruments. The findings of this study are consistent with and relevant to the Kenyan context, as the previous chapter demonstrated. The emergence of ADMIs presents a notable opportunity for inclusion. Unlike traditional instruments, ADMIs lack prescriptive rules regarding 'correct' playing techniques, and this flexibility encourages curiosity, experimentation, and a sense of (musical) empowerment among users (Frid and Ilsar, 2021). Rolvsjord (2004) characterises musical empowerment as the ability to engage with music on one's own terms, reclaiming the fundamental rights to experience, perform, and interpret music. Thus, musical empowerment is achieved through creativity as disabled people gain autonomy and agency in their musical expression.

The Youth Music (2020) study further identifies cost as a significant impediment to accessibility in music education, with 67% of participants highlighting the prohibitive cost as a considerable challenge. Notably, only 7% of the surveyed (disabled) participants reported having access to music education, underscoring the widespread impact of financial (among other) barriers. Particularly concerning is the exclusive affordability of adapted instruments, rendering them accessible primarily to those with economic means, and the general ignorance about mainstream adapted instruments, given that only 12.5 % of (instrument) retailer participants indicated knowing how and where to find them.

In contrast, the development of digital music instruments presents a cost-effective alternative, especially compared to the cost of purchasing mainstream adapted instruments (Frid, 2018; 2019). Given that this cost efficiency is pronounced in high-income economies such as the UK, the potential of digital music instruments, with their cost-related advantages, emerges as a promising avenue for enhancing music education accessibility for disabled people in Kenya,

considering the country's status as a developing middle-income economy (see World Bank Open Data, n.d.). Despite its competitive edge, adaptive music technology has been relatively unexplored in the computer music literature (Graham-Knight and Tzanetakis, 2015; Ward, Davis and Bevan, 2019).

3.3. A Review of ADMIs

While there is no (publicly available) literature on digital instruments in Kenya and the African continent, there has been a growing interest in ADMIs in the UK by charity organisations, social enterprises, academic researchers, conferences and individuals (Frid, 2019; Samuels, 2019; Samuels and Schroeder, 2019). These include the Drake Music Project, OpenUp Music and Adaptive Use Musical Instruments Projects, Able Orchestra, Digit Music and the Queen's University Belfast's Performance without Barriers Research Group. Other international organisations include the New Interfaces for Musical Expression (NIME), an annual conference dedicated to scientific research in digital music tools (see Fasciani and Goode, 2021).

Since different users have different physical, cognitive and sensory needs, critical concepts for constructing ADMIs include the ease of customisation and adaptation to users' unique needs (Förster, 2023), which may not be possible with traditional acoustic instruments, as earlier demonstrated. Similarly, the successful and effective development of ADMIs entails user participation and interdisciplinary development teams (Dickens, Greenhalgh and Koleva, 2018; Samuels, 2019). The involvement of users during the developmental phase of the ADMIs is a pivotal consideration, consistent with the universal maxim of disability advocacy, "(there is) nothing about us without us", which underscores the indispensable role of the voices of disabled people in shaping all interventions intended to impact their lives (Charlton, 1998; Scotch, 2009; Callus and Camilleri-Zahra, 2019; Bahner, 2022; Oduor, 2022).

While traditional acoustic instruments produce multi-sensory outputs, most ADMIs produce unilateral auditory output (Farrimond, Gillard, Bott et al. 2011). Multimodal feedback is beneficial as it creates a similar sense of control of sound creation as acoustic instruments and reinforces the interconnectedness inherent in musical interaction, enabling the relationship of cause and effect between the instrument and the musician (Frid, 2019). Such multimodal output is also helpful in music therapy settings and for people with multiple disabilities. People in such circumstances frequently find themselves with limited chances to influence their surroundings, leading to feelings of powerlessness. However, the multimodal output might be overwhelming for some musicians with certain conditions, such as autism (Ibid.).

Another vital aspect of ADMIs, as Samuels and Schroeder (2019) note, is its facilitation of free improvisation, inherent in African music (Locke, 1980), as an element of musicking which creates space for difference, allowing for a diversity of voices and meanings and thus leading to the inclusion of, among others, disabled people in music-making. In line with this observation, Emerson and Egermann (2020) note that the need to create responsive systems for improvisation is a crucial reason for electronic musicians' desire to build new digital instruments. Samuels and Schroeder (2019) conceptualise improvisation as an inclusive, socio-political activity that allows musicians to explore their instruments in varied, unconventional ways while concurrently fostering alternative modes of social organisation. This approach confronts the hierarchical frameworks entrenched within traditional Western music and challenges prevailing structures within political systems.

The improvisational aspects of ADMIs present an avenue to challenge Kenyan music education's prescriptive and narrow definition and practice of musicking. As Chapter One highlighted, the system currently has a narrow approach to music-making, which could rightly be characterised as a 'one-size-fits-all' approach that borrows heavily from the Western classical tradition. Notably, improvisation is not given any attention in the KCSE music exam, which reflects what teachers and students typically emphasise, as Chapter One shows. The use of ADMIs in Kenyan music education, therefore, not only promises to lead to the inclusion of disabled people in the music-making experience but also raises important (political) questions that challenge the status quo to the point of redefining what constitutes a 'musical instrument' and 'music-making'.

There are numerous commercial ADMIs with different input interfaces. These include instruments like the *Soundbeam,* which uses contactless sensors (see Soundbeam, n.d.), *MotionComposer*, a video-based ADMI (see Bergsland and Wechsler, 2016) and breath-controlled sensors ADMIs like the *Magic Flute* (see My Breath My Music, n.d; see also Ward, Davis and Bevan, 2019). Some ADMIs emerge within project-based academic environments, such as the light-sensor-based *SnoeSky* (see Förster, Komesker and Schnell, 2020) and *LoopBlocks* (see Förster and Komesker, 2021), and some are created as bespoke ADMIs tailored for specific users (see Lucas, Schroeder and Ortiz, 2020). Few ADMIs are designed for blind people, deaf people, older adults and very young children (Frid, 2019), and gesture-controlled ADMIs (see Iijima, Shitara, Sarcar et al., 2021), and the use of machine learning in ADMI development remains rare (Frid and Ilsar, 2021).

Other modern technologies include brain-computer music interfaces (Miranda, 2006; Moghimi, Kushki, Marie Guerguerian et al., 2013) and eye-controlled music interfaces (Davanzo and Avanzini, 2020). *Netychords* is an example of an ADMI controlled through eye and head tracking (see Davanzo, De Filippis and Avanzini, 2021; Davanzo and Avanzini, 2022; Davanzo, Avanzini, Ludovico, et al., 2023). There are also wearable interfaces/prosthetic apparatus, controllers activated by oral manipulation, auditory interfaces, eye-tracking devices, touchscreen interfaces, and interfaces controlled through mouse input (Frid, 2019). *Clarion*, developed by Open Up Music, can be played independently with any body part (Open Up Music, n.d.; see also Gall, 2022; Ward, 2023). *The EyeHarp*, a free-access gaze-controlled ADMI, is another notable instrument that enables people with severe motor disabilities like cerebral palsy to create music (Vamvakousis and Ramirez, 2011; Vamvakousis and Ramirez, 2016; Ramirez-Melendez, 2023).

Although there has been increasing literature on the design and assessment of ADMIs within particular application contexts, scant literature exists regarding the practical implementation of ADMIs within schools catering to special educational needs (Förster, 2023). Förster (2023) studies the use of ADMIs in special schools in Germany, where he notes that ADMIs are not only valuable for those with impairments but also for those who face accessibility barriers due to exclusive social practices that exclude them from music-making. In an earlier study, Pessoa, Parauta, Luís et al. (2020) noted a general trend of increased interest in digital music instruments (DMIs) for (regular) education presented at the NIME conference from 2001 to 2019. One of the benefits of DMIs in education noted in this review includes the considerable potential they exhibit in stimulating students' engagement to study and practise music due to the quicker results gained compared to traditional orchestral instruments. Another advantage observed is that the development of DMIs typically utilises affordable technologies, such as smartphones, ensuring heightened convenience and adaptability to individual needs and preferences. Moreover, DMIs allow musicians to create soundscapes, reimagining local and global cultural heritages and fostering diversity through emulating multifaceted musical traditions within the digital sound realm. Given the extensive array of available DMIs, Pessoa, Parauta, Luís et al. (2020) advocate for a heightened emphasis on devising pedagogical strategies for their integration into music curricula.

In my earlier (2024) dissertation, Digit Music's *CMPSR* was considered a possible solution for the Kenyan context in the earlier stages of the study. As a MIDI controller, *CMPSR* mimics the movements and muscle memory that wheelchair users gain from using a wheelchair joystick

(see Inspire Youth Arts, 2023). This has enabled members of the Able Orchestra, some of whom are profoundly disabled wheelchair users with CP, to make music in inclusive ensembles involving collaborations with the UK's leading orchestras, including the BBC Concert Orchestra, BBC Symphony Orchestra, the Hallé and Symphonia Viva. The apparent effectiveness of *CMPSR* as a music accessibility solution for people with CP, as some members of the Able Orchestra are, made it a promising solution for the Kenyan case, given that Wangui's (2019) isolated study in Kenya also primarily focused on CP. However, the controller was expensive (£299) and required other software solutions, such as Bitwig, Logic, Ableton, Protools, Garageband, Soundtrap and Bandlab, which would be costly to implement in an underfunded school context in Kenya and beyond the financial means available for the study.

3.4. *JoyInst*: a new ADMI for the case of Kenya

As the preceding section illustrated, numerous commercial and bespoke ADMIs are available in the Western world. However, due to various considerations, it was imperative to develop a new ADMI or adapt an existing one for the case of Kenya. First, the distinctive requisites of the Kenyan curriculum, particulary concerning African music performance elements, necessitated the integration of sound samples sourced from diverse traditional musical instruments such as kayamba, kiringongo and chivoti, a feature that existing ADMIs would lack as they are primarily designed for a Western market. Additionally, the short duration of the earlier research project and limited financial resources precluded the exploration of alternative ADMIs, which necessitated the development of *MachAInst*, and ealier version of *JoyInst*.

The prevailing music education funding challenges in Kenya, discussed in Chapter One, further underscore the necessity for creating the most cost-effective ADMI, thereby prompting the selection of video game controllers, which promise to be more economically viable and widely accessible hardware options. This assumption was based on recent studies indicating the increasing widespread playing of video games around the world (see, for instance, Shliakhovchuk and Muñoz García, 2020; Carpita, Muti, Nardi et al., 2021), an observation made in the African continent, albeit with limited literature (Penix-Tadsen, 2019; Bayeck, 2020). In recognition of the widespread use of video games, Murigu (2023) examines the potency of integrating digital video game-based learning in school instructional design to foster self-confidence and enhance performance for pupils in basic education in Kenya. His study concludes that video game-based learning promotes blissful productivity as students find rewarding activities meaningful. As such, students learning through digital games work harder than they usually would to achieve blissful productivity. Murigu (2023) thus advocates

for adopting video game-based learning to promote the accessibility of education in the country. This gamification of learning presented by video games was an equally important consideration in the development of *JoyInst,* as it would promote engagement, a hypothesis that the next chapter will investigate.

One should note, however, that the creation of *JoyInst* was intended to provide a software solution rather than a hardware one. As such, the study aimed to create a cost-effective software solution that allows various hardware solutions for various users, as the previous section demonstrated that users have different needs. This study used two hardware solutions, a Logitech F310 controller (worth about £ 20) and a Sony access controller (worth about £ 70), to accommodate a broader range of user (physical) needs. It was estimated that most players would use the (cheaper) Logitech F310, and *JoyInst* would accommodate other hardware solutions later in its development. At this point, it is also worth mentioning that the process of creating *JoyInst* involved, from the onset, a collaborative effort and consultation with the Digital Score Project, which designed and developed the software. Since this study focuses on how *JoyInst* can mitigate the barriers hindering access to music rather than the intricate technical mechanics of the instrument, this section would not be unduly concerned with providing exhaustive descriptions of the latter.

While the gamification of learning was an important consideration in designing *JoyInst,* it was equally important to make it a challenging instrument to learn, like a traditional instrument. In a study conducted in the Drake Music Project, Samuels (2019) observes that in some cases, disabled musicians did not want to use an ADMI that differentiates them from other musicians or an oversimplified "toy-like" interface that demands little respect. In line with this observation, making *JoyInst* a challenging instrument requiring much technical skill and music theory understanding to master at a virtuosic level, like a traditional instrument, could make it as respected as a traditional instrument that both disabled and non-disabled people would proudly learn. Consequently, this would make the music-making experience inclusive, allowing disabled and non-disabled musicians to work together rather than dichotomising music-making for disabled and non-disabled musicians. Put a different way, making this a challenging instrument would bridge the gap of inclusive music-making rather than creating more barriers by creating different classes of musicians: disabled musicians, on the one hand, playing simplified 'toy-like' instruments, and non-disabled musicians, on the other hand, playing 'serious' instruments. Consequently, *JoyInst* would highlight (musical) competence over the individual user's difference (disability). This design framework also aligns the instrument with the universal design principles discussed in the previous chapter.

Another consideration worth mentioning here, a minor one but important, is the limitation of expertise in ADMIs in Kenya. This is evidenced by the lack of literature and the limited investment made in special needs music education in the country, which made it necessary to make *JoyInst* an easy-to-use instrument that can be operated with little or no expert knowledge.

3.5. Chapter Summary

This chapter has given a background discussion in the field of inclusive music practice and its underlying theoretical substructure, postulating that music is a fundamental human right for all, disabled or non-disabled people and that music-making is a self-justifying act. The chapter traces early efforts for musical (disability) inclusion, from adapted instruments to the conveniences that ADMIs provide today. There was a need to develop a new ADMI, *JoyInst*, to address the specific needs of special needs music education in the Kenyan context.

CHAPTER 4

A LONGITUDINAL CASE STUDY AT SA JOYTOWN SECONDARY SCHOOL

4.1. Chapter Overview

This chapter presents a detailed discussion of the use of *JoyInst* as an example of a technology-based solution at SA Joytown Secondary School for an aggregated period of one year. It will discuss the study design, methods employed, analyse the data collected, discuss the implications and limitations of the study, and propose areas for further research.

4.2. SA Joytown Secondary School

Joytown is a co-educational boarding primary and secondary school for learners with physical disabilities in Thika town, Kiambu County, Kenya. The schools are adjacent and were founded by the Salvation Army, hence the 'SA', starting with the primary school in 1962 and, later, the secondary school in 1980. Though founded and sponsored by the Salvation Army, Joytown is funded by the government and offers the Kenyan national education system. While Joytown predominantly caters for physical disabilities, there are students with complex multiple disabilities, such as combinations of physical disabilities and neurodiversity.

SA Joytown Secondary School was selected for this study as it is the only secondary school for physically disabled students that offers music in the 8-4-4 system. Joytown is also a national school, which gives it the potential to have a national outlook as it is open to disabled (and a few non-disabled) students from across the country. This further provides the study with the potential to have a national impact and a representative sample of students from different parts of Kenya.

In my undergraduate work, I carried out a short case study at Joytown Secondary, where I collected data using an earlier version of *Joyinst* called *MachAInst*. This work was carried out with the full support of the University of Nottingham's DigiScore project. DigiScore was particularly instrumental in developing the instrument following a need identification process with Professor Craig Vear. The initial short study was carried out for a week in March 2024, and it gave positive results that then necessitated a longitudinal study where the impact could be studied for a longer time. It was in this context that the extended study was born. The longitudinal study, which was a research fellowship with the Digital Score Project at the University of Nottingham, involved working with Joytown music teacher and pupils for an aggregated period of one year, and the development of more rigorous research tools and design, which will be detailed later.

Before my undergraduate dissertation, I worked as a volunteer music tutor at Joytown Secondary since 2022 with the Harmony Kenya Foundation. This volunteering experience created a working relationship with the school, thus making Joytown ideal as a case study. The existing working relationship was especially helpful given the short duration of the initial study and the considerable time it may take to establish another working relationship with another school. It is also worth mentioning, for purposes of disclosures, that my personal interest in the school may also result from the fact that I studied at Joytown Primary School for the last two years of my primary education. However, the primary and most important reason for selecting Joytown as the case study is the fact that Joytown is a national secondary school for physically disabled students offering music in the current 8-4-4 system. Its national outlook and diversity of student ability levels make it an ideal place to carry out the study. Similarly, it gives the study the potential for the findings to impact students from different parts of Kenya.

4.3. Ethical Considerations

The longitudinal study was conducted in strict adherence to the ethical requirements of the University of Nottingham, the Kenyan Ministry of Education, the Kenya National Commission for Science, Technology and Innovation and the SA Joytown Secondary School administration. In this regard, the University of Nottingham School of Humanities' ethical committee gave ethical approval for the study. Similarly, the sub-county director of education (a representative of the Ministry of Education) in the Thika area, where Joytown is located, approved the study, subject to obtaining a research licence from the National Commission for Science, Technology and Innovation (NACOSTI), which was obtained, and a copy of the same is annexed in this paper. The principal of Joytown, Dr Evelyn Andolo, also approved the study in writing, and a copy of the letter is herein annexed. All these approvals were obtained with full disclosure of the purpose and methods employed in the study.

The participants of this study were initially incuded the current music teacher at Joytown, the late Mr Benjamin Karehu; a sample of current music students at the school from different year groups, Ms Elizabeth Wangui Muriithi, the previous music teacher at Joytown; and Dr Evekyn Andolo, the school principal. Each participant under sixteen obtained a parental consent form, which the parents signed as required by the University of Nottingham School of Humanities' ethical committee. Pupils above the age of sixteen were able to sign the consent forms for themselves.

The professional participants (Mr Karehu, Dr Andolo and Ms Muriithi) gave informed consent to participate in the study and to be mentioned by name as they gave their input in a professional capacity.[8] Any students named during the interview with the professional participants were anonymised. Similarly, the names of student participants were anonymised for purposes of confidentiality. The number of sessions, duration, and times allocated for the study were decided at mutual convenience with the music teacher, the student participants and the school administration without exerting any undue pressure whatsoever. As the information sheets issued to the participants emphasised, participation in this study was voluntary, and participants were free to withdraw at any point they so wished.

4.4. Study Design

This study employed a longitudinal mixed-methods case study design to evaluate the accessibility and learning impacts of *JoyInst* when it was integrated into instrumental tuition at SA Joytown Secondary School. The study employed a sample of 16 volunteer student participants from different year groups and with varying disabilities. As the school has a few non-disabled students, one participant did not have a disability, and this was important in supporting inclusive, collaborative music-making. The variety of ability levels would also enhance the transferability of findings across user needs. The participants engaged in a total of ten weekly lessons aligned with a common curriculum. These ten sessions were spread across two school terms. The curriculum was drawn from *The School Recorder Book 1,* which is widely used in Kenyan secondary schools to teach the recorder. As an earlier chapter noted, most KCSE students either sing or play the recorder for their practical (performance) tests. As such, the *School Recorder Book 1* content was built in the *JoyInst* curriculum, such that *JoyInst* players could learn the exercises therein in a gamified manner. The sessions involved some students playing their recorders, some playing *JoyInst*, some singing, and me playing the piano to accompany each of the exercises.

At the beginning of the study, we administered a baseline music assessment using two tools. The first tool was a standard music test to measure musical skills like scales, arpeggios, and sight-reading excerpts from *The School Recorder Book 1* and other KICD-approved sight-reading materials appropriate for the level of each participant. These tests were done on the original instrument that the participants played. As such, those who were recorder players did their tests on the recorder, while the singers did their tests on voice. The second tool was a

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[8] NOTE: Mr Karehu lost his life before we managed to conduct the interview, hence the omission of the same in this paper.

Likert scale questionnaire meant to measure the students' level of engagement, confidence, and social interaction in music-making. This was administered at the bingeing to measure any changes that might occur in these aspects as a result of introducing the *JoyInst* intervention.

During the study, the Likert scale questionnaire administered at the beginning was subsequently administered at the end of every session throughout the study to see how the intervention would influence these three parameters. Another objective participation metric was the weekly attendance records, which would have utility in measuring any correlation between achievement levels and attendance. During the intervention, *JoyInst* was introduced in weekly sessions, and repeated measures (end-of-session Likert questionnaires) captured individual students' trajectories of change throughout the study.

At the end of the study, an endline standard music test was administered to measure the extent to which the participants' musical skills, like scales, arpeggios, and sight-reading, had changed. The skill changes were benchmarked against curriculum progression relative to baseline assessment. Semi-structured interviews with the classroom teacher elicited rich accounts of usability, inclusion, and perceived impact in the Kenyan school context. To elicit these insights, we employed open questions, probing questions, reflective questions, comparison questions and contextualised questions. We also did a focus group discussion with the students at the end of the study to validate and qualify the data collected through the other tools. We employed the Socratic questioning strategy used by educators to elicit critical thinking and mine for quality responses, which, apart from validating and qualifying the data collected through previous tools, would inform future developments of the research.

Apart from the Socratic approach to questioning, the study employed open-ended questions during the focus groups and semi-structured interviews, which offered participants the opportunity to elaborate on their experiences and perspectives. We also used some follow-up or probing questions aimed at encouraging participants to elaborate on their answers. Likewise, *JoyInst*'s impact on participants' learning and motivation was complex, and reflective questions helped most participants to think deeply about that aspect. These were supplemented by comparison questions that helped participants differentiate between their experiences with *JoyInst* and traditional instruments in order to gauge the specific impact of the intervention. Finally, asking contextualised questions tailored to the specific challenges faced by Disabled students in Kenya (informed by the research in earlier chapters) ensured that we acquired insights that were relevant to the Kenyan context. The combination of all

these strategies enabled us to collect data that had a qualitative richness and could be quantified in order to provide a comprehensive, nuanced understanding of *JoyInst*'s impact.

Overall, the study integrated methodological triangulation through the use of quantitative (descriptive statistics of engagement, participation, social interaction and skill growth) and qualitative (thematic and content analysis of the interviews and focus group narratives) frameworks to construct a fuller picture of *JoyInst*'s educational value. The use of repeated-measures questionnaires strengthened internal validity while capturing within-learner change over time, and the use of multi-informant interviews (students and educators) for constructs such as motivation and inclusion bolstered construct validity. The combination of these methods ensured a methodological rigour that would enable us to collect reliable, practice-relevant evidence on how accessible digital musical instruments helped to reduce participation barriers and facilitated equitable access to music-making.

4.5. Research Questions

As its predecessor, this longitudinal study aimed to investigate the following research questions about integrating *JoyInst* into music education at SA Joytown Secondary School:

1. To what extent did *JoyInst* reduce physical and practical barriers to accessing instrumental music learning for Disabled students?

2. In what ways did *JoyInst* improve long-term learning outcomes and lesson-to-lesson engagement relative to baseline and to peers learning on traditional instruments?

3. How did the customisable features of *JoyInst* align with individual learners' physical needs to increase (sustained) participation and sustained involvement?

4. To what degree did using *JoyInst* enhance students' motivation and self-confidence in music lessons?

5. How did the integration of *JoyInst* influence social inclusion and collaborative music-making between Disabled and non-disabled students over the study period?

4.6. Hypotheses

The study tested the following hypotheses regarding the integration of JoyInst into music education at SA Joytown Secondary School:

1. *JoyInst* would reduce physical and practical barriers to instrumental learning for Disabled students, increasing their ability to participate in lessons.

2. The use of *JoyInst* would promote improved long-term learning outcomes (curriculum progression and skills tests) and lesson-to-lesson engagement relative to baseline and to peers using traditional instruments.

3. The customisable features of *JoyInst* would align with individual learners' physical needs, resulting in higher participation and sustained involvement.

4. Using *JoyInst* would increase students' motivation and self-confidence in music lessons, as reflected in repeated Likert measures and interview narratives.

5. Integrating *JoyInst* would have enhanced social inclusion and collaborative music-making between Disabled and non-disabled students over the study period.

4.7. Methodology

As outlined in the earlier study design section, we employed a longitudinal mixed-methods case study design to investigate the impact of *JoyInst* on music education accessibility for Disabled students. The study had a sample of 10 students with different needs who participated in ten weekly music-making sessions across two school terms. The music-making sessions were collaborative and inclusive, as they had students playing different instruments, from different year groups and with different disabilities and ability levels, all of whom were using a common curriculum. This diversity of participants enhances the applicability of findings to diverse learner needs.

At the outset, a baseline assessment captured musical skills, engagement, confidence, and social interaction using a combination of standardised music tests, attendance records, and Likert questionnaires. During the intervention, *JoyInst* was integrated into lessons, and weekly repeated measures tracked changes in engagement, motivation, confidence, and social interaction. Likert scale questionnaires were chosen as they are relatively easy to gather data (Nemoto and Beglar, 2014). The validity of the conclusions drawn from the data they present can be confirmed through various methods, and data collected can also be effectively analysed alongside qualitative data collection techniques, including participant observation, and asking open-ended questions in interviews (Ibid.).

During the semi-structured interviews with teachers and other stakeholders and the focus group discussions with the students, we employed open-ended, probing, reflective, comparison, and contextualised questions to elicit detailed qualitative insights regarding usability, accessibility, and collaborative learning experiences. At the end of the study, we also

had a focus group discussion with the student participants, wherein we employed the Socratic questioning strategy to elicit quality responses from the participants.

The quantitative data were analysed by using descriptive statistics to outline the skill development, participation, and engagement, and the qualitative data by thematic and content analysis to recognise the recurring experiences and perceptions. This approach of using more than one method increased the internal and construct validity of the study and gave a thorough and practically relevant assessment of the role of *JoyInst* in improving disabled students' musical learning, confidence, and social inclusion.

4.8. Summary of Previous Findings

In the previous study, data on the effectiveness of the ADMI as a music-making tool and a teaching and learning tool were gathered on six parameters, as indicated in the questions below. These questions were in a Likert scale questionnaire.

1. The students are interested in playing the instrument
2. The students find the instrument easy to use
3. The students find this instrument engaging
4. The instrument enhances students' creativity
5. The instrument allows students to develop their musicianship progressively
6. The instrument enhances students' classroom learning experience

The responses to all six parameters assessed in the questionnaires were in the "agree" to "strongly agree" range. This was a strong indication that the instrument was well-received on every dimension assessed. Students reported a high level of interest in playing the instrument, perceived it as easy to use, and consistently described it as engaging. They further agreed that the tool enhances creativity, supports progressive development of musicianship (e.g., scales, sight-reading, composition, improvisation), and improves the overall classroom learning experience. These quantitative patterns were further echoed in teacher interviews: sustained on-task behaviour, visible enthusiasm (including among previously less-engaged learners), and smooth uptake even by students without prior gaming experience, suggesting usability and engagement benefits are broadly accessible.

Practical affordances such as ease of customisation (e.g., remapping for left-handed use) and potential for automatic notation were highlighted as ways the instrument can bridge theory and practice and further strengthen learning outcomes. Overall, the Likert data, observations

and teacher interviews showed that the instrument is an effective teaching and learning tool that motivates participation, scaffolds musical growth, and enriches classroom experiences.

4.9. Findings and Discussions

The Likert questionnaire measured three major outcomes of the intervention of *JoyInst,* namely Engagement, Confidence, and Social Interaction. Each component comprised five items rated on a 5-point scale, starting from "Strongly Disagree" (1) to "Strongly Agree" (5). Data were collected from 16 participants across 10 sessions spread over two school terms. The quantitative results reflect participants' evolving perceptions of their learning experience, personal growth, and sense of inclusion within the group. The analysis includes only sessions with questionnaire responses. As such, missing values were due to non-attendance, and participants marked as absent were excluded from all mean calculations. Each session's mean scores reflect the perceptions of only those students who were present and active in that session.

Attendance varied across sessions, ranging from 4 to 15 participants per session (see Table 1). The lowest attendance was recorded in Session 1 with four participants, while the highest participation occurred in Session 5 with fifteen participants. Fluctuations in attendance were mainly due to the program's scheduling periods. The initial intervention stage was in school Term 2 (May to July), and the advanced phase was in school Term 3 (September to October). Despite minor variability, consistent engagement from a core group of participants ensured valid trend analysis.

Sessions	Students Present	Engagement Mean	Confidence Mean	Social Mean
Session 1	4	3.30	3.50	3.60
Session 2	12	4.41	4.42	4.24
Session 3	5	4.44	4.20	4.12
Session 4	12	4.57	4.52	4.52
Session 5	15	4.40	4.59	4.51
Session 6	6	4.83	4.67	4.74
Session 7	6	4.86	4.77	4.80
Session 8	5	4.64	4.73	4.84
Session 9	6	3.93	3.63	3.77
Session 10	5	4.16	4.20	4.32

Table 1: Session attendance and mean scores

4.9.1 Likert-scale questionnaires data

Key Findings (Summary)

- **Engagement** increased significantly over time, rising from 3.30 in Session 1 to a peak of 4.86 in Session 7, thus indicating strong and growing participant involvement in the music-making activities.
- **Confidence** also showed a steady upward trajectory, increasing from 3.50 to 4.77. Confidence was strongly correlated with engagement (r = 0.93), suggesting a close relationship between motivation and self-perceived competence.
- **Social Interaction** remained consistently high throughout the study, with an overall mean of 4.35. This indicates a stable and collaborative music-making environment.
- **Strong correlations** were found between Social Interaction and Confidence (r = 0.97) and Social Interaction and Confidence and Engagement (r = 0.91), highlighting the importance of social inclusion in enhancing both participation and confidence.
- **Minor declines** in Engagement and Confidence during Session 10 appeared linked to reduced attendance and participant fatigue. This decline was followed by a recovery in the final session.

Trends in the Engagement component showed a steep upward trajectory from an average of 3.30 in Session 1 to an all-time climax of 4.86 by Session 7. The steepest curve of improvement was observed between Sessions 1 and 4, suggesting that the participants had a notably rapid uptake of the program's music-making activities. Levels of engagement remained high through the mid-phase (Sessions 5–8), which indicates that there was a sustained interest in the music-making sessions. A small descent was observed in Session 10 (3.93), which corresponded with reduced attendance and possible fatigue, followed by a rebound to 4.16 in the final session.

The Confidence component followed an increasing trend over the study period, just like engagement, going from an average of 3.50 during session 1 to 4.77 during session 7. Confidence and engagement scores remained closely interconnected to the self-perception of competence, with a correlation coefficient of 0.93. This suggests participants' motivation and self-perception of competence were strongly linked during the study period. The late phase drop to 3.63 (session 10) appeared identical to the drop in attendance, which suggests the self-confidence of participants was influenced by the group/peer effect. The increase to 4.20 in the final session suggests regained momentum after the peer attendance became stable. This suggests that Confidence was strongly linked to peer attendance.

The Social Interaction component was the third factor measured using the Likert scale questionnaire. This dimension maintained consistently high values throughout the study. In the first session, it averaged at 3.60 and had its peak in the eighth session, where it averaged at 4.84. Throughout the study, the overall mean for this dimension was 4.35, and it had the lowest value in Standard Deviation of 0.42 among all the components tested. This data shows that there was a stable, positive and socially interactive (collaborative) music-making environment. The Social Interaction component also had strong correlations with both Confidence ($r = 0.97$) and Engagement ($r = 0.91$). This shows that social inclusion reinforced both the participants' enjoyment of music-making and their self-perception of competence. The participants consistently expressed feelings of belonging, teamwork, and mutual support. This goes to show that the workshops were successful in fostering a collaborative, inclusive atmosphere for music-making.

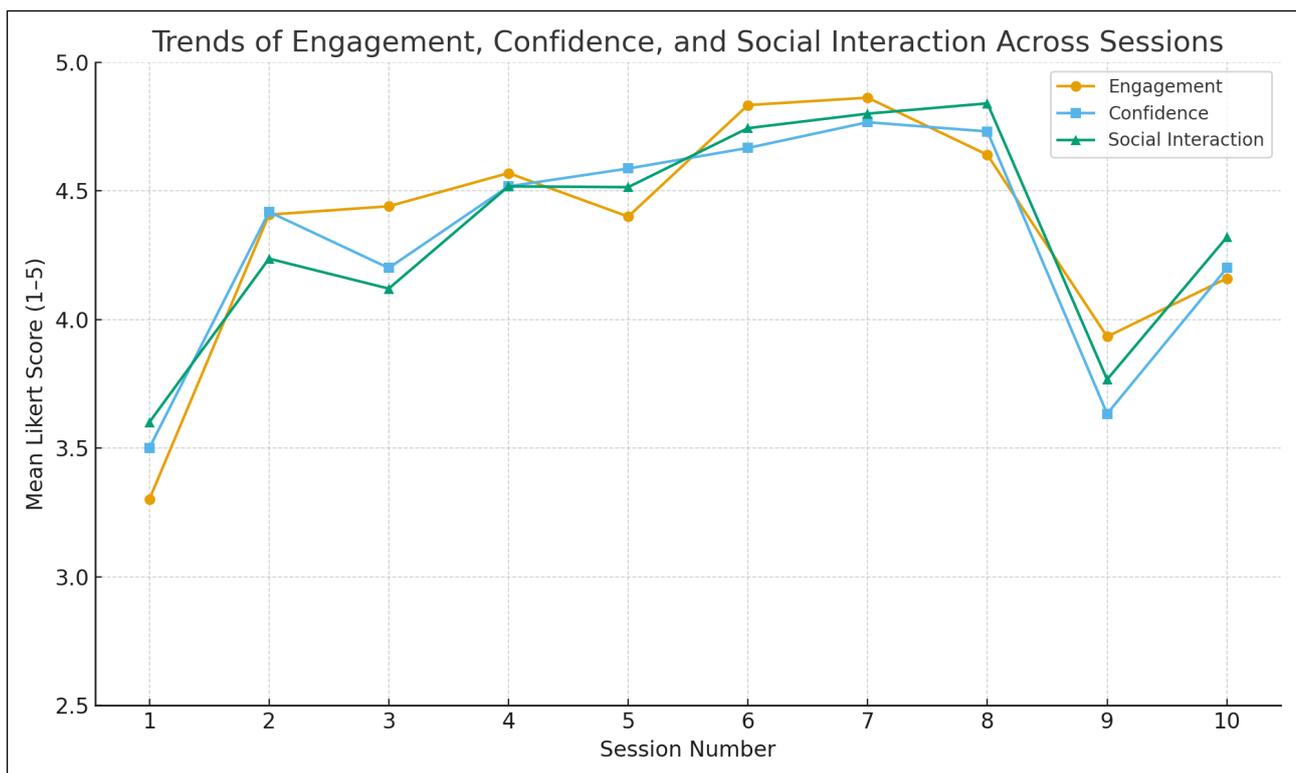The tables and charts below summarise the findings.

Chart 1: Trends in engagement, confidence and social interaction in all 10 sessions

Construct Pair	r Value	Strength of Relationship	Interpretation
Engagement ↔ Confidence	0.93	Very strong positive	Sessions with higher engagement also had higher confidence.
Engagement ↔ Social Interaction	0.91	Very strong positive	When participants were more engaged, they also interacted more socially.
Confidence ↔ Social Interaction	0.97	Very strong positive	When participants' confidence grew, social inclusion and peer connection strengthened.

Table 2: Summary of the relationship between different constructs.

Construct	Mean Score	SD	Interpretation
Engagement	4.35	0.47	Small variation; engagement remained steadily high across sessions.
Confidence	4.32	0.44	Consistent improvement; scores clustered close to the mean.
Social Interaction	4.35	0.42	Most stable construct, showing highly uniform participant experiences.

Table 3: Summary of the standard deviation of the three constructs

Variable Pair	r Value	Strength of Relationship	Interpretation
Attendance ↔ Engagement	**0.24**	Weak–moderate positive	Sessions with better attendance tended to have slightly higher engagement.
Attendance ↔ Confidence	**0.36**	Moderate positive	More consistent attendance contributed to stronger confidence gains.
Attendance ↔ Social Interaction	**0.21**	Weak positive	Higher attendance modestly supported stronger social interactions.

Table 4: Summary of the relationship between attendance and different constructs.

4.9.2. Pre and post-intervention standardised music test

Key Findings (Summary)

- **Overall musical proficiency** improved across the cohort, with average scores increasing from 64.2% (pre-intervention test) to 75.8% (post--intervention test).
- **Individual participants' performance:** Four out of six participants showed notable improvement (10–30 percentage points), while two maintained stable performance. No participant showed an overall decline.
- **Participants with lower baseline scores** showed the greatest improvement, suggesting the intervention may have had an equalising effect on musical skill development.
- **Scales** improved overall (a group-mean increase of about 30%), though progress varied across individuals. All but one participant showed significant gains, and one showed a decline linked to inconsistent attendance.
- **Melody** performance improved for most participants, indicating enhanced melodic fluency after the intervention.
- **Sight reading** showed the most consistent improvement, with several participants achieving large gains and no participant demonstrating a decline.

When it came to the standardised music test, three major components were tested. The test was administered twice, at the beginning and at the very end of the study, to measure the changes in the practical competencies the learners acquired. Six of the participants completed both the baseline and post-intervention tests, and so this is the data that was analysed. Across the cohort, there was a general improvement in musical proficiency from pre-test to post-test. At baseline, the overall scores were between 50% and 85%, and post-intervention scores were between 60% and 90%. The six participants showed significant improvement, with four out of six recording a growth of 15-30 per cent, thereby depicting positive learning patterns throughout the intervention.

Scores in the scales component of the practical test depicted significant improvement in most learners. An example is that Participant 1 scored 1/5 and 4/5 at the end. Similarly, Participant PN moved from a score of 3/5 to 4/, whereas Participant TM recorded an average score of 4/5 in both tests. Only a single participant (PM) showed a decline in scores from 3/5 at the baseline to 1/5 at the last test, indicating the individual difference in progress. In general, the trend of the group indicated an improving pitch and tonal control through the study duration.

The tables and graphs below summarise the findings.

INITIAL TEST RESULTS

Participant	Scales	Playing a melody	Sight Reading	Overall score
CO	1/5	7/10	4/5	60%
KT	3/5	7/10	2/5	60%
MK	2/5	7/10	4/5	65%
P N	3/5	7/10	3/5	65%
PM	3/5	6/10	1/5	50%
TM	4/5	9/10	4/5	85%

Table 5: Summary of pre-intervention results

FINAL TEST RESULTS

| Participant	Scales	Playing a melody	Sight Reading	Overall score
CO	4/5	9/10	4/5	90%
KT	3/5	5/10	4/5	60%
MK	2/5	9/10	5/5	80%
P N	4/5	8/10	4/5	80%
PM	1/5	7/10	4/5	60%
TM	4/5	9/10	4/5	85%

Table 6: Summary of post-intervention results
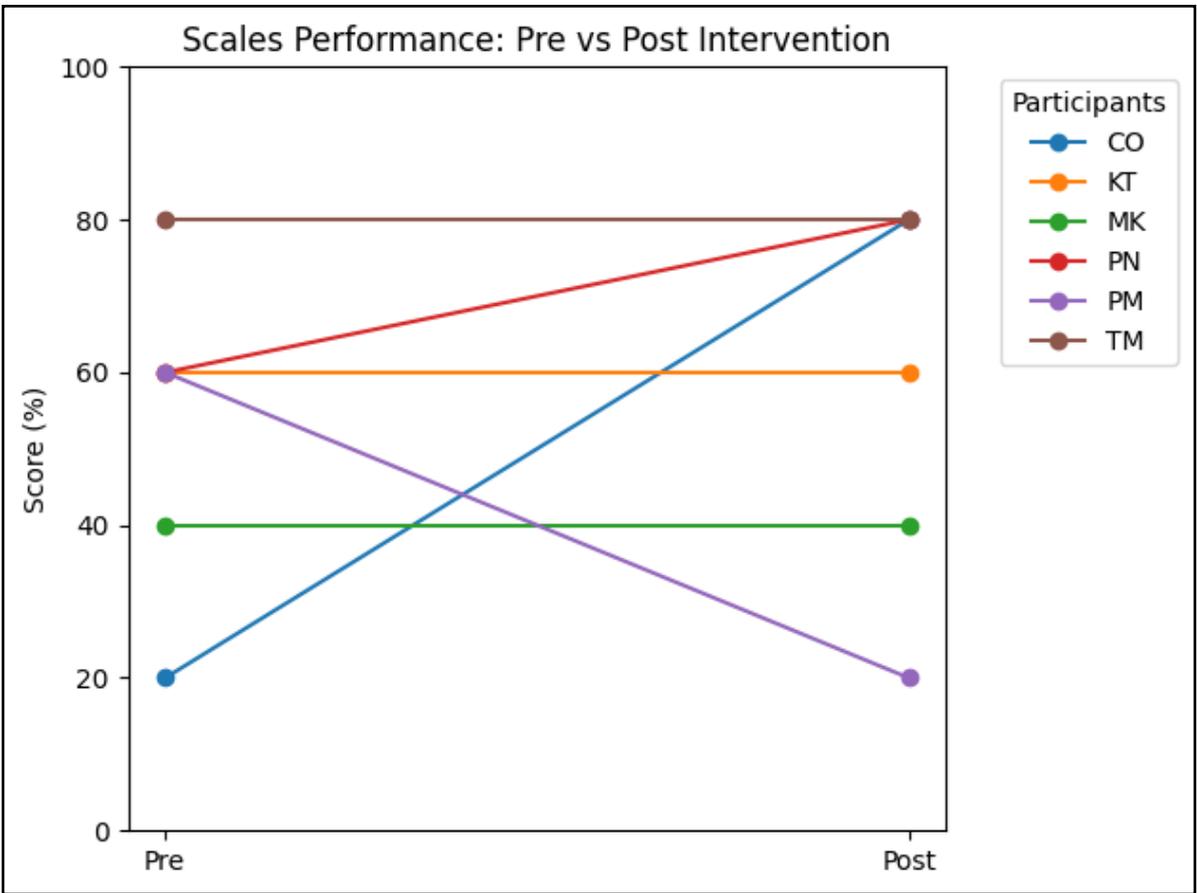
*Graph 1: Summary of individual participant achievements
in the scale strand before and after the intervention*
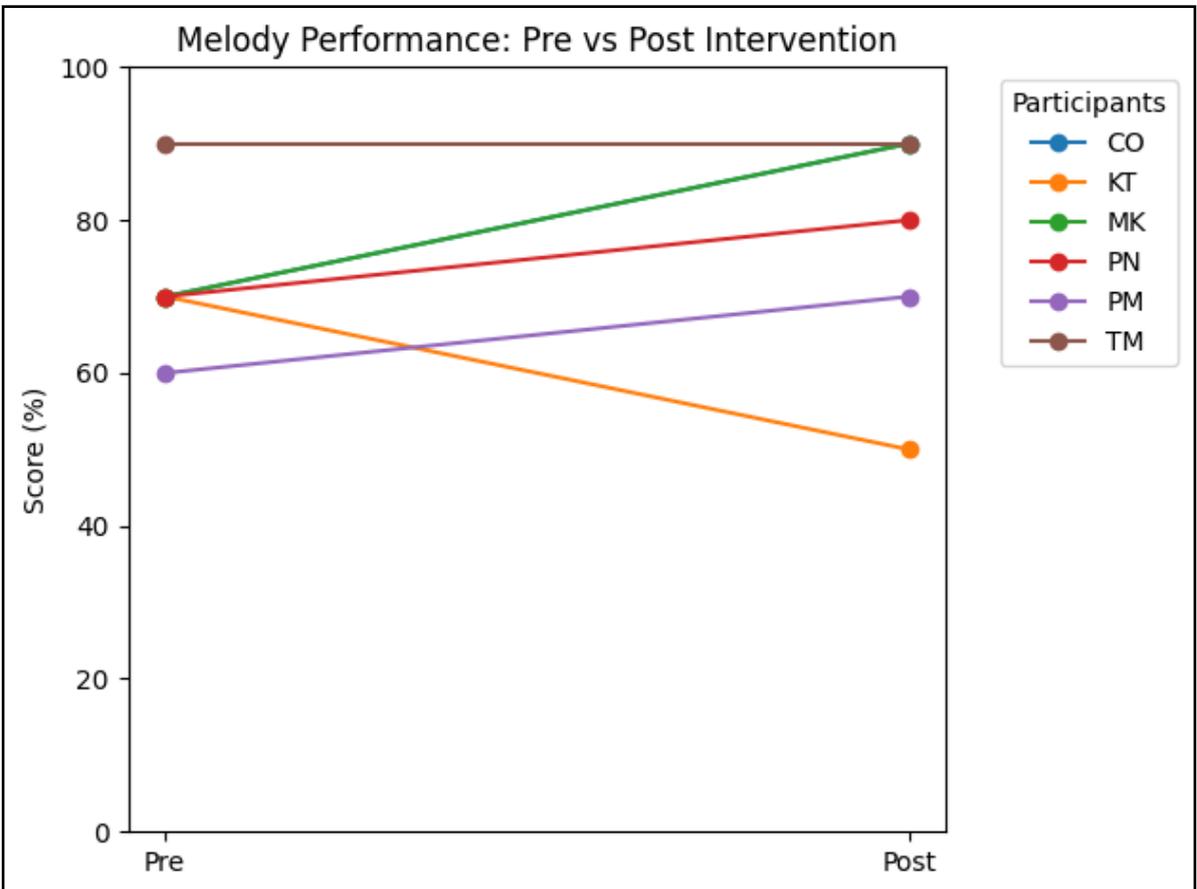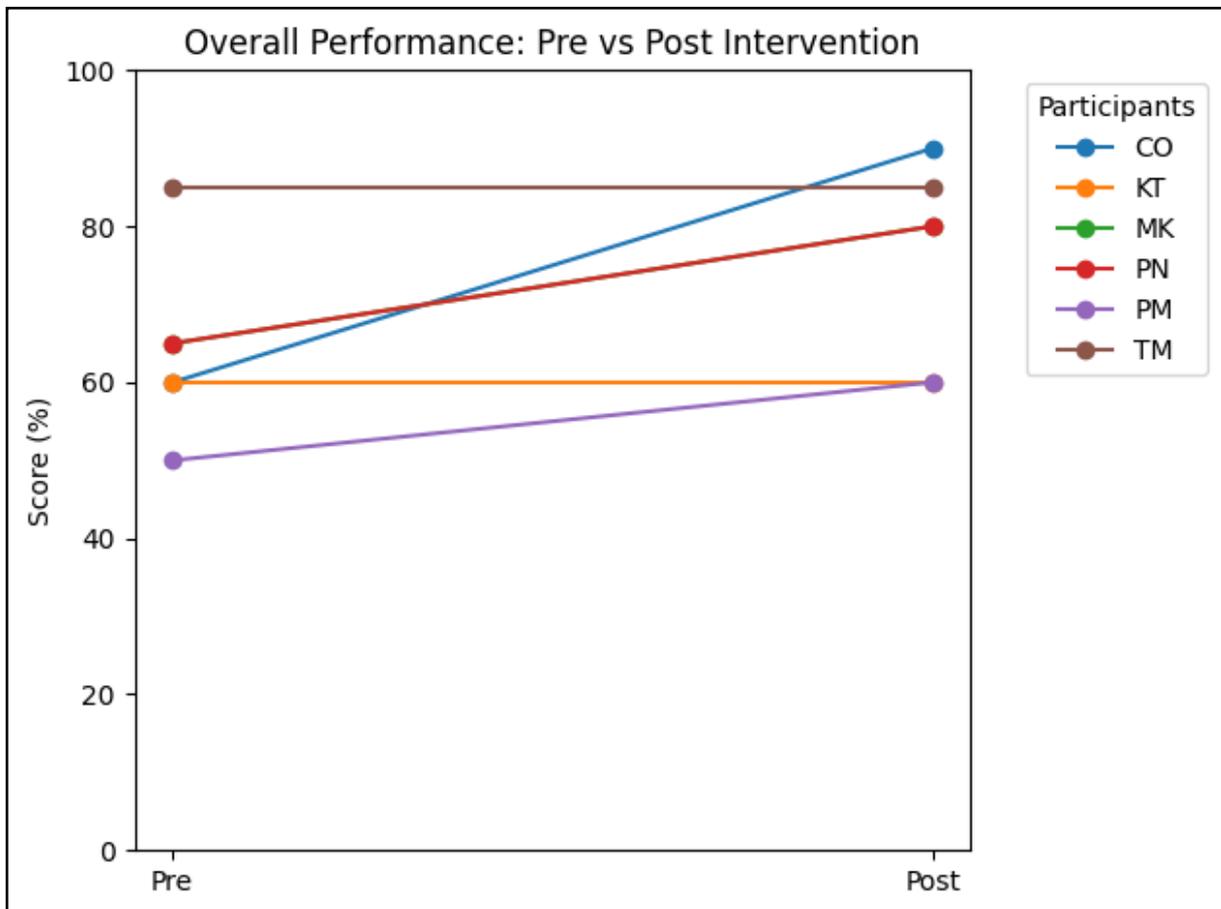

*Graph 2: Summary of individual participant achievements
in the melody strand before and after the intervention*
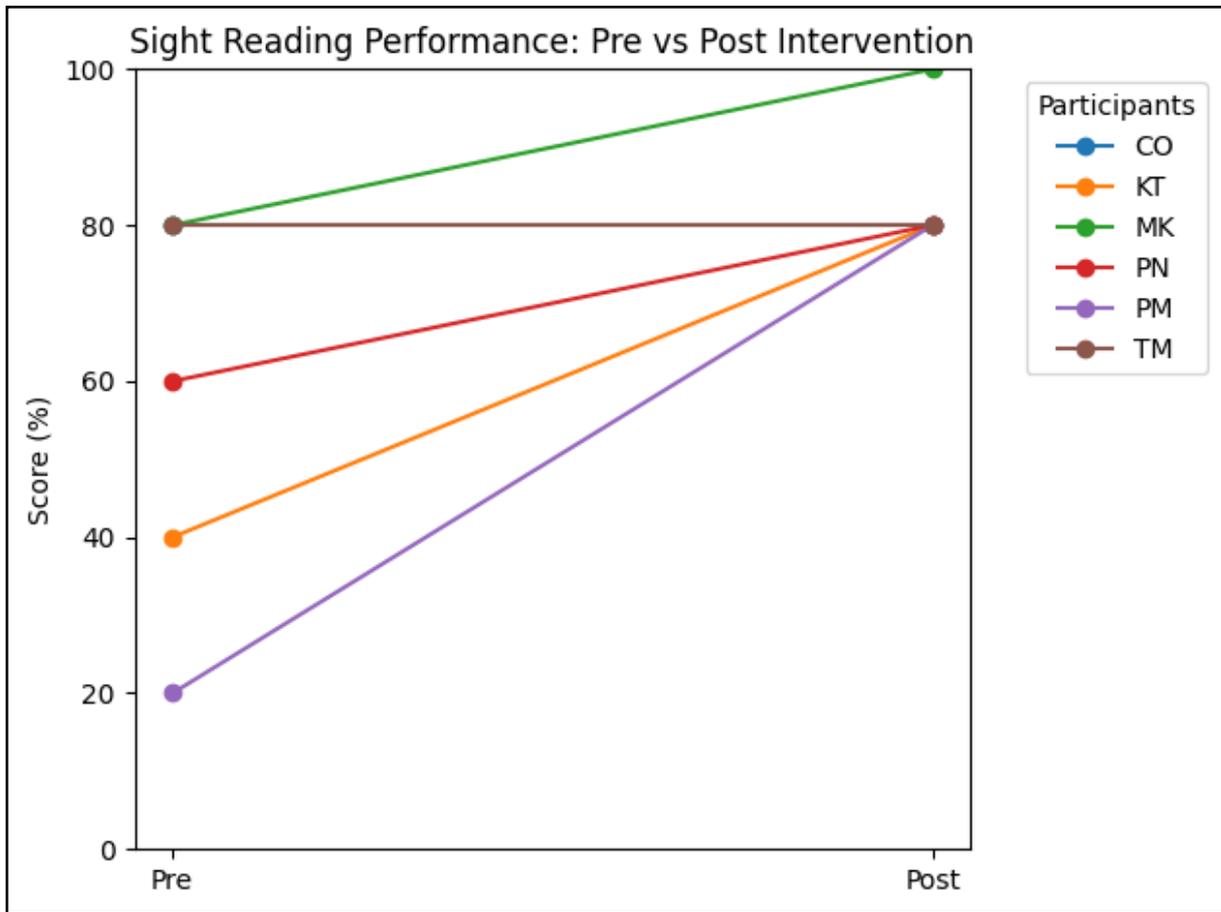
*Graph 3: Summary of individual participant achievements
in the sight reading strand before and after the intervention*

*Graph 4: Summary of individual participants' overall achievements
before and after the intervention*

As the data in the above tables and graphs indicate, pre-intervention and post-intervention comparisons show that all the strands (Scales, Melody Performance, Sight Reading and Overall Score) were measurably improved. Achievement levels in scales were variable, but, in general, positive changes were noted. Two participants exhibited notably significant improvements (CO: +60 percentage points; PN: +20), whereas TM maintained steady results (80% at both tests). MK did not show any difference, and PM had a decrease (−40), which can be explained by inconsistent attendance. Overall, improvement in this strand was seen more among selected individuals rather than uniformly distributed across the group, though there was an overall group mean improvement (+30%).

When it comes to playing melodies, most participants showed an improvement. CO and MK were up by 20 percentage points, and PN and PM were up by 10. TM maintained good performance (90) in the two tests. The decline was observed in one participant (KT) (−20). On the whole, the trends of post-intervention scores are positive in the majority of participants, which implies an improvement in melodic fluency after the intervention.

Sight reading was the most steady and the most improved strand among the three. There were significant improvements in four participants (KT, MK, PN, and PM), and PM had the highest increase in this strand. MK scored 100% in the post-test from an initial 80%. Two participants (CO and TM) maintained a high performance (80 %) in both pre and post-intervention tests. There was no participant who showed a decrease in sight reading, which means that the improvement was strong and the gains were retained. This would be rechoed in the focus group discussion as detailed in the later section.

The overall performance was improved with the average percentage point, and the difference was 11.6 between the pre-test and the post-test of 64.2 to 75.8. Four participants demonstrated general improvement (CO: +30; MK: +15; PN: +15; PM: +10), and two did not improve (KT and TM). None of the participants exhibited a general decrease. The most significant overall improvement was observed in the participants who had lower baseline scores, especially in the areas of sight reading and overall mean, which indicates a possible equalising effect of the intervention. Those that started with better baseline performance (e.g., TM) were more likely to sustain and not significantly improve scores, which points towards ceiling effects in the specific strands.

4.9.3 Insights from Student Focus Group Discussion

Key Findings (Summary)

- **Accessibility and inclusivity:** *JoyInst* enabled students with physical or respiratory limitations to participate in music-making using minimal physical effort. It allowed some to play with one hand and reduced reliance on breath control.

- **Increased motivation and enjoyment:** Students described the instrument as fun, engaging, and video-game-like. This increased their enthusiasm for music lessons and encouraged greater participation.

- **Skill and confidence development:** Participants reported improvements in sight-reading, musical understanding, and overall confidence. This was supported by the instrument's visual feedback and accessible design.

- **Broader educational impact:** The experience fostered greater resilience and self-belief. Some students reported increased confidence in other subjects, such as Mathematics and Physics.

- **Future potential and professional value**: Students viewed *JoyInst* not only as a learning tool but also as a potential examination instrument and a medium for professional performance, capable of creating economic opportunities.

- **Suggestions for improvement:** Participants recommended technical and pedagogical enhancements. These included easier octave shifting, instrument customisation for one-handed users, more sound options, composition features, and a self-assessment or exam mode.

Apart from the Likert scale questionnaire data, the study also employed a post-intervention focus group discussion, in which we asked the participants questions about their experiences using *JoyInst*. The discussion shows that the instrument generally had a positive impact on students' music-making experiences. As such, students found the instrument to be engaging and motivating, and they viewed it as a tool that can bridge the gaps that physical disabilities cause in music-making. The discussion can be categorised into six major components.

The first component pertains to Accessibility and Inclusivity. In this regard, participants viewed *JoyInst* as a useful tool that enables students with limited hand function or breathing difficulties to make music at an equal level with those without disabilities. Unlike a traditional instrument like the recorder, which needs a player to have both hands, *JoyInst* can be played with one hand, thus making it a more inclusive instrument. Participants reported that this

made them feel a greater sense of belonging and self-confidence during music lessons, and they felt equally as competent to make music. In the words of one participant, "on the recorder, I only have one hand that is fully functional[…], but with this joystick, I can work with just my functional right hand." This was a student who had felt excluded from music-making due to having challenges with one of his hands, so he could not play the recorder, and he was not a particularly keen singer. Consequently, he had felt excluded from the music-making experience.

Another participant commented, "You see[…] not all of us have the ability to move our fingers quickly… however, we can still make music on JoyInst." Still, another participant commented that "If someone's breath is not enough[…] just moving the joystick, which does not require too much energy, they can still be able to make music." This last comment brought the second dimension of accessibility that *JoyInst* was bridging. Apart from those with physical and movement challenges, some participants had disabilities that made them unable to have enough to sustain long phrases on the recorder. However, on this instrument, they felt included as they only needed to use their hands, and without requiring too much energy. These kinds of participants would include those with osteogenesis imperfecta, who often experience shortness of breath and are unable to play an instrument that needs strong hand engagement.

The second dimension pertains to motivation and enjoyment. In this regard, the participants felt the instrument was fun and relatable, often comparing it to playing video games such as PlayStation. The gamification of learning and music-making increased their enthusiasm for class participation and encouraged independent practice. In the words of one participant, "It has made me more eager to participate in music-making […]I looked forward to playing it because I also play video games." Another participant commented, "associating it with the fun video games made me pay more attention[…] more than the recorder."

This second comment can be extrapolated to make broader points about the advantages that digital solutions like *JoyInst* offer over more traditional instruments like the recorder. In this regard, a different participant mentioned that "Associating it with the fun video games made me pay more attention[…] more than the recorder." Still, another one mentioned that "It is attractive, and it gives you morale, wanting to know how to play it." To quote a last participant, she mentioned that "When someone plays *JoyInst*, it looks more interesting than when they play a recorder." These comments go to show that digital solutions offer opportunities that may be unavailable on traditional instruments. Not only can they gamify learning, which is an

important pedagogical tool for students, but it also allows them to develop their music skills and appreciate music theory in new ways, as will be shown in the next paragraph.

The third dimension pertains to skill and confidence development among the students. In this regard, the participants reported improvements in sight-reading, aural awareness, and overall musical confidence. These improvements were credited to the visual feedback (displaying played notes as one is playing), as it enhanced their reading accuracy and allowed the students to correct themselves when they made a mistake. One participant mentioned that "My sight-reading has improved a lot[...] my ability to learn a piece has improved." Participant P, who has hand movement challenges, also expressed his experience thus: "Previously, I was not very good at playing the recorder[...] but on JoyInst, it took me one day to play the whole scale of C." This feeling of competence was also reported by other participants, citing the visual stimuli and accessibility solutions the instrument offered them. As a result, *JoyInst* made them more willing to take part in class and ensemble activities. To quote one participant, "I can say it has made me more confident[...] I now feel more confident to participate in class." Another participant puts it thus, "Previously, I was not very good at playing the recorder[...], but on *JoyInst*, it took me one day to play the whole scale of C." These feelings of competence and a positive self-image were reflected in the participants' reflections on the broader implications of this study, which will be discussed shortly. As a previous chapter has shown, the constant exclusion from participating in education in general can cause many learners with disabilities to develop a negative self-image, such as an inferiority complex. These digital solutions enabled them to unleash their abilities and made them feel capable of being productive contributors in society at large, and capable of achieving their dreams if the gaps are bridged. To aid their learning, some student reccomned the inclusion of a self-assessment and an exam mode on *JoyInst* to aid independent practice.

As an earlier section has highlighted, the *JoyInst* intervention not only had an impact on music education but also had a greater educational impact on the part of the students. In this regard, participants linked the *JoyInst* experience to increased resilience and self-belief in other subjects, particularly Maths and Physics. They felt it showed that effort, which they need to put in order to become good in music, and adaptability, which is offered by digital solutions like *JoyInst*, can help them overcome physical or learning barriers. One participant rejected that it made him ask himself, "Since I can now make music on *JoyInst*, why can't I put in more effort (in other subjects) so that I can also be as good as everyone else?" This attitude was developed as a result of realising that *JoyInst* was not necessarily an easier "toy" instrument

for disabled people. On the contrary, it required effort, like any other instrument, to develop proficiency in it. The students were then able to transfer the learning of that attitude to other areas, too. One puts it thus: "Everything needs effort[...] even Mathematics, which I believed was very hard, I can get better at it with practice."

The same sentiments were captured from two other participants who put their experiences thus: "For me, it has made me believe that I can do physics, which I used to find hard." Participant T said, "Now I feel as if I can do hard things." Previously, he had taken the alternative B in mathematics, which is designed for learners with disabilities. This is less meant to be easier than the alternative A, which all regular students take. What makes Alternative B more accessible is that it removes all requirements for geometric constructions, which many students with disabilities are unable to undertake. However, on the downside, it is not perceived as equal, an easier way out. Participant T felt that with digital solutions like *JoyInst*, he too can take alternative A and be able to do geometric constructions. As the alternative A has more academic rigour, it would allow him to further his education in mathematics in the post-secondary stages. In other words, one can say that this experience had a positive impact on the students' perceptions of not only music but also other subjects that require physical movements.

This was also reflected in their attitudes towards the future. The students saw *JoyInst* as both a musical and an entrepreneurial opportunity. On the musical aspect, the students suggested the inclusion of *JoyInst* in national music exams like the KCSE. Participant D suggested having an exam mode on the instrument where it was not displaying the notes being played, which would not give a *JoyInst* player any advantage over, say, a piano player. This suggestion was well-received by the other students. Apart from the exam utility of *JoyInst,* the students also saw the potential for economic utility. To participant T, when one gets very proficient in *JoyInst*, they can be able to engage in paid professional opportunities like other traditional instrumentalists. In the participant's words, "I can also earn from playing this when I am very good at it." This shows that the participants viewed the instrument like any other traditional instrument. It was regarded as an instrument one can play professionally, so it is not a mere classroom teaching aid, or an (inferior) disabled people's toy.

Given that the development of *JoyInst* is still a work in progress, we were keen to hear students' feedback on the possible improvements that could be made to the instrument. The first technical suggestion was concerning the octave shifting function. Students suggested having easier octave shifting to have the instrument reset automatically. While that technical functionality is not the primary focus of this paper, it does have some implications for the student experiences partying with the instrument, and so it becomes an important action point for the next phase of development. The participants also raised suggestions for customisation for one-handed users. The possibility of making such modifications/ customisations further highlights another advantage that digital tools like *JoyInst* have over traditional instruments. While such a modification would need a simple rewriting of codes and possibly a different game controller, it would be quite costly on a traditional instrument and almost unaffordable for a school like Joytown. The students also suggested having a broader range of tones to select from. The ability to create percussion accompaniments, such as drums, was suggested as it would enable the students to accompany themselves when singing.

Participants also suggested developing a composition function on the instrument, so that those learners who are unable to write on a manuscript book can use *JoyInst* in their examination. Finally, the students suggested having a self-assessment or exam mode function on the instrument. This would be helpful in their independent practice, and they can also take tests set by teachers on *JoyInst*. One participant viewed this in the broader lens of developing independence, where persons with disabilities desire to find tools that allow them to do things for themselves rather than having other people do things for them. For instance, this participant gave an example of the KCSE exam, where some students who are unable to write for themselves are given a provision of a scriber (someone to type for them) as a reasonable accommodation. These scribers, he said, may not always write what and how you want them to write. Similarly, having a tool like *JoyInst* that has a composition function means that someone who cannot write due to a disability can compose music for themselves without needing to use a scriber. This would not only reinforce the feeling of competence but also ensure that the work produced is a true reflection of the student's artistic intentions and not the scriber's perception or interpretation of the student's intentions.

4.9.4 Interviews with stakeholders

Key Findings (Summary):

- **Alignment with inclusive education goals**: Stakeholders viewed *JoyInst* as a tool that supports accessibility. They aligned this with the independent pupil-centred learning, a key principle promoted by Kenya's new Competency-Based Curriculum (CBC).

- **Pedagogical and developmental value**: *JoyInst* was seen to promote technical musical skills, creativity, responsibility, and self-efficacy while increasing student engagement in music lessons.

- **Learner empowerment**: The instrument was perceived to enhance confidence, independence, and resilience, with benefits extending beyond music to other areas of learning and daily life.

- **Assessment potential**: *JoyInst* could support digital and practical assessment methods through functions such as automated grading, recorded performances, and portfolio-based evaluation aligned with CBC practices.

- **Implementation requirements**: Successful adoption would require teacher training, institutional support, policy alignment, and access to technological resources.

- **Potential limitations**: Stakeholders cautioned against overdependence on technology and highlighted the need to consider cultural relevance, accessibility, and equitable participation.

- **Cross-curricular opportunities**: *JoyInst* may support learning in other subjects through gamification and music-based approaches to teaching concepts across disciplines.

In addition to the data from the student participants, the interviews with Elizabeth Wangui Muriithi, a former music teacher at Joytown and a pioneering researcher of inclusive music education, and Dr Evelyn Andolo, the current principal of Joytown, shed light on the future of *JoyInst* in changing the face of inclusive music education in Kenya. In both interviews, there were a few important themes, which were alignment with the inclusion goals, pedagogical value, learner empowerment, assessment implications, implementation considerations, limitations, and cross-curricular potential.

When it comes to *JoyInst*'s alignment with inclusive education, both stakeholders placed *JoyInst* as a handy tool to promote inclusion. Elizabeth added that under the Competency-Based Curriculum (CBC), learners do not necessarily depend on the teacher, other than to guide him or her, and that the ability of the learner to achieve a lot is possible with the use of that gadget. On the same note, Evelyn emphasised the all-inclusive nature of technology, where AI and IT enhance inclusion in that, "what I am unable to do physically, AI can assist me in doing it [...]. It makes a difference." Both of the perspectives have shown that *JoyInst* contributes to physical accessibility as well as to the larger pedagogical goals of independent learning promoted by the CBC and equal access to music education.

On the aspect of pedagogical value and learning development, *JoyInst* was reported to be a means of advancing necessary cognitive and socio-emotional skills. Elizabeth underlined its contribution to developing responsibility and integrity, thus, "there is the virtue of responsibility and integrity, they will train them and limit themselves to the application of that digital device to that particular purpose it was created." The instrument (self-efficacy) and creativity were also identified by Elizabeth as they helped to contribute towards self-efficacy and imagination. She found that learners believe in themselves and possess some creativity and imagination. Evelyn also emphasised these arguments, explaining how the instrument allows learners with physical difficulties to discover musical opportunities: "I do not have hands. Now I can play drums (on this digital tool)[...] It makes a difference. She also observed a greater participation/engagement of the learners in music-making following the introduction of *JoyInst* at the school. A combination of these insights implies that JoyInst contributes to the development of technical skills, as well as more general competencies of the learner, which would contribute to the overall growth of the person.

Another common theme involved the potential of *JoyInst* to change the assessment practices. Elizabeth proposed that grading can be made easier with the help of the software and that independent assessment is possible. To her, "when we already have a system that is able to grade the examination, we can design the software in such a way that a student is able to do an examination on the system; it will save time". Evelyn developed this, and the ability of the instrument to record actual demonstrations of ability: "the instrument of that sort assists the student in presenting thier project in a more practical manner than to attempt to employ a device with which they cannot even manage to lift." These observations highlight the fit between *JoyInst* and CBC principles, which indicates its applicability to the continuous and

alternative assessment methods, such as portfolios and school-based practical assessment processes.

One of the key lessons of the two interviews consisted of the ability of *JoyInst* to make learners more empowered, which led to confidence, independence, and persistence. Elizabeth noted that learners can learn on their own, which constructs their self-efficacy; thus, critical self-directed learning skills were developed. The transferability of these competencies is also similar in Evelyn, who stated that the self-confidence of learners in music transfers to their day-to-day activities and their studies. The learners then apply these in the area of music and or other areas in addition to music. These testimonials point out the fact that the instrument does not just aid in learning music but also fosters attributes that lead to success in other areas of study and life in general.

The two stakeholders emphasised the readiness of teachers and support of institutions towards the adoption of digital tools like *JoyInst*. Elizabeth clarified that the tool can be taught on the use so that the educators can train the students on how they can use it without supervision and Evelyn stressed on the importance of training, creating awareness and access to resources in order to become sustainable: "There must be training to the individuals who will promote them to continue being so once we create awareness more people will feel like learning it". Aligning policies was another point which was discussed by Elizabeth, and *JoyInst* already has initiatives of the government under the CBC, and Evelyn argued that national-level recognition might help to implement and legitimise it further. The above results emphasise that a concerted effort that comes up with teacher training, policy facilitation, and proper infrastructure is required.

Although the stakeholders were optimistic overall, they did highlight some potential threats. Elizabeth was also against the reliance on technology, and emphasised the need to be culturally sensitive: "We also must make sure that we do not make our young people technology dependent; the introduction of new technologies must be respectful of the culture of people to which it is imported". Evelyn highlighted pragmatic constraints in terms of access and involvement, indicating that success is determined by the availability, adoption, and inclusion of the entire variety of student skills.

The two interviews pointed to the possibilities of JoyInst to influence other areas of learning, other than music. Evelyn observed that the confidence and persistence that they received due to using *JoyInst* transfers to their daily lives and academic work, and proposed that

gamification would enable them to engage better in other subjects. As an illustration, content might be encoded through music, e.g. composing songs about geographical features, which would enhance memorisation and learning by being more interactive. This indicates that *JoyInst* has the potential to educate new cross-curricular policies, which use music and technology to support learning across various fields.

On the whole, the interviews suggest that *JoyInst* is a potential development in inclusive music education in Kenya. It promotes accessibility, learner autonomy, engagement, and self-efficacy and is in line with curriculum goals and new CBC assessment practices. A successful adoption will be achieved by means of teacher training, supporting policies, access to resources, and consideration of cultural relevance. Besides, its possible cross-curricular use suggests even greater educational relevance, that trancends the specific domain of music.

4.10. Limitations and Areas of Further Research

While this longitudinal study was a significant improvement over the initial shorter study, there were areas of limitations and a need for further research. One of the limitations was the inconsistent attendance of the participants in the workshops. This meant that certain data had to be removed from the final analysis due to incompleteness. Having a more consistent attendance would have produced more consistent data. However, the fluctuations in attendance were also quite telling in the achievement levels of the students. One of the less consistent participants pointed it out during the focus group discussion, where he felt that his more consistent peers had grown significantly in comparison.

On another dimension, there were technical challenges that limited access to *JoyInst* during music-making sessions. In most workshops, only one computer was available, and therefore, some students would not get the opportunity to engage with the instrument. One participant highlighted the impact of this during the focus group discussion, where she noted that she did not engage with *JoyInst* long enough. With Bettwe acess to the instrument, she felt that she would be fully able to comment on its impact on her as a musician. In the future, it would be useful to have *JoyInst* working on several devices, which would allow the students to engage with it more and thus give more quantitative data on their development. One participant commented on this, noting that, unlike the recorder, which he has almost every time and can play it anywhere, he did not have the same level of access to *JoyInst.* This, he explained, may be the reason why he was more proficient at the recorder and felt more confident playing it. As such, the next stages of this study can find a way to have more devices in order for students to continue playing the instrument, even outside workshop time.

4.11. Chapter Summary

Overall, the results of this longitudinal study point to the great importance of *JoyInst* as an affordable digital tool in promoting disability-inclusive music education. The interviews with stakeholders and the data collected from students show that the tool is effective in minimising the long-term obstacles encountered by physically or cognitively challenged learners and allowing them to engage in music-making processes to their full extent. Students who had little hand or breath control even reported feeling more competent and included, and one student stated, "I only have one fully functional hand [...], but with this joystick, I can work with the functional right hand." Such experiences indicate that *JoyInst* helps to overcome the barrier between disabled learners and their colleagues and provides a more equal learning experience.

These observations are backed by quantitative data, as the engagement, confidence, and social interaction showed consistent improvement across the course of the intervention. The levels of engagement increased from 3.30 to 4.86, whereas the confidence level improved from 3.50 to 4.77, and the social interaction remained relatively stable with a mean of 4.35. The usefulness of the instrument in enhancing the competence and self-efficacy was also supported by the fact that the pre and post intervention musical tests showed improvement in terms of the practical skills, sight-reading, and tonal control. Students explained the device as inspirational and fun, frequently comparing it to video games, which stimulated practising on their own and being creative.

Students further reported greater educational values, as they attributed their achievement to *JoyInst* with greater resilience and confidence in other disciplines that are not music, like Mathematics and Physics. They also realised that it is accessible and can be used professionally, as they gave suggestions such as composition modes and examination functionality, where they can be used to facilitate independent practice and fair assessment.

In sum, the chapter shows that innovative ADMIs like *JoyInst* can be useful tools in promoting inclusiveness, engagement, skill building and self-confidence in the music education process. The positive effects of such technologies are not limited to the classroom. Rather, they facilitate the development of transferable skills like self-directed learning and empowerment among the learners with different needs. These results invite further research, investment, and policy reforms to provide more students with such digital solutions and to make inclusive music education a universal right for all students.

CONCLUSIONS

The results of this longitudinal study demonstrate strong evidence that innovative technologies like *JoyInst* can be a very effective tool to improve the field of inclusive music education in schools in Kenya. The combination of the findings of the interviews with Elizabeth Wangui Muriithi and Dr Evelyn Andolo and the quantitative and qualitative statistics of the students shows that the intervention had a positive influence on the aspects of accessibility, learner engagement, confidence, and social inclusion.

JoyInst has solved major limitations that students with disabilities used to encounter in music education. Both stakeholders highlighted *JoyInst's* ability to facilitate involvement in areas where their involvement had been limited before by physical constraints. Elizabeth mentioned that learners using the device were able to achieve much; learners do not depend on the teacher, in general, unless they need to be guided, whereas Evelyn thought that the instrument provided students with a chance to meet musical targets that they were previously unable to meet. For instance, students without hands could play drums using the joystick, which "makes a difference". These views were also echoed by focus group discussions with the students; learners noted that *JoyInst* enabled them to fully participate despite the physical limitation. One student, who said he had only a fully functional hand on the recorder, explained that, with the joystick, he could work with his (only functional) right hand, as the instrument accommodates his physical needs.

The numeric data reflected the high and long-term improvements in the most crucial outcomes. The improvement was 31.8% as the engagement in the initial session was 3.30, then it grew to 4.86 in Session 7, whereas confidence improved from 3.50 to 4.77. The level of social interaction was also high (mean value 4.35), which demonstrated that collaborative and inclusive learning conditions were created. The effectiveness of the instrument was also confirmed by pre and post intervention measures of musical skills, where four out of six respondents improved their practical music skills by 15-30 per cent, especially in pitch, tonal control, and sight-reading. These trends indicate that *JoyInst* not only facilitates access but also facilitates quantifiable skill development, self-efficacy, and autonomy, which are in line with Kenya's new education system (CBC).

There were other advantages which the students emphasised, such as increased motivation, fun, and transferability of the skills to other academic subjects. Some respondents associated their success with *JoyInst* with the greater perseverance in other subjects like Mathematics and Physics, and this showed a wider educational influence. "Because I can now compose

music on *JoyInst*", one of the participants remarked, "why can I not work harder [...] so that I can be just as good as everybody?" This is in line with the insights in the interview that point to the role of *JoyInst* in establishing self-confidence and agency, with Elizabeth noting that learners become assertive and are able to stand on their own, and Evelyn noting that self-efficacy acquired in the form of music is transferred into everyday academic life.

In addition, students perceived *JoyInst* as being of long-term potential, including assessment and professional use. The proposed features of a self-assessment mode, composition features, and an exam feature suggest a wish of the learners to feel autonomous and have a fair playground in showing their music competence. They also thought of entrepreneurial and professional prospects, remarking that if (other) people make a living out of playing other orchestral instruments, "(we) can also make money from this (*JoyInst*) when (we are) so good at it". This shows that *JoyInst* is not a new instrument that only students with disabilities can utilise, but a versatile tool that anyone, whether or not they have a disability, can make use of.

All these pieces of evidence indicate that *JoyInst* facilitates several core outcomes in line with the goals of inclusive education and Competency-Based Curriculum (CBC). As such, digital tools like *JoyInst* encourage learner-centred pedagogy, make education more accessible, encourage collaboration, and build confidence and skills. To have successful implementation on a large scale will demand teacher training, infrastructure support, and policy recognition, as evidenced by Elizabeth and Evelyn. It is also worth noting that cultural relevance, fair access and responsible use of technology should be paid attention to so as to have sustainable adoption.

To sum it up, innovative ADMI's like *JoyInst* present a new paradigm of inclusive music education. They improve musical competence and psychosocial development by addressing the physical and cognitive barriers, facilitating engagement, and facilitating quantifiable learning outcomes. The opportunities offered by such technologies are not limited to music, but transferable skills and attitudes are capable of making a positive contribution to further educational success. In the long-term, cross-curricular and national assessment systems would be an area of future studies to fully capitalise on *JoyInst* in the pursuit of equitable learner-centred education in Kenya. All these would be in the backdrop of the wider educational shift from the content-based 8-4-4 system to the more technology-based and inclusive Competency-Based Education system that was introduced in 2017.

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