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The Extra-Ordinary Music Camp: An informal online distance learning approach for children with intellectual and physical disabilities and learning disorders

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In summer 2020, 25 children aged 8–17 with intellectual and physical disabilities and learning disorders participated in a research project called the Extra-Ordinary Music Camp. The objectives were to (1) provide an adapted environment where extra-ordinary children could develop musical creativity; and (2) examine the impact of informal, inclusive, participatory, and adapted creative music activities on specific development areas. Individual 20–40-min online sessions were delivered at a distance biweekly for 7 weeks. Mixed methods analysis was used to determine the effects. Results show shared improvement across the communication and social skills measures, and improvements for all participants in community use, musical skills, autonomy, and technology skills. Notably, the improvements in community use (ABAS-II) and communication (specifically developed questionnaire) were significant.

KEYWORDS

informal music learning, distance learning, social skills, communication, intellectual and developmental disabilities (IDDs)

Rationale

Music interventions can foster development in children with disabilities (CWD) in many domains (Brown and Jellison, 2012; Jellison and Draper, 2015; Gemma et al., 2020), including a range of functional skill areas (Hooper et al., 2008). However, individuals with disabilities face substantial barriers from participating in creative music making activities (Rathgeber, 2017). These obstacles are many and multi-leveled: they may be physical, cognitive, social, and/or access related (McHale, 2016; Rathgeber, 2017). Moreover, reviews of the literature on music and CWD reveal that studies seldom, if ever, consider the participant's *role* or *voice* when measuring the effects

of music activities. Thus, a scoping review (Després et al., 2021b) underscores that studies generally fail to clarify whether the interventions involved active participation in music activities as opposed to either active or passive listening (e.g., background music). Nor do studies necessarily distinguish between therapeutic interventions (e.g., to reduce behavioral problems) and interventions meant to teach musical skills.

In the collective vision called the Framework for 21st Century Learning (BattelleforKids, 2019), creativity is considered an essential skill to prepare students for a complex future. Creativity is also an essential component of all musical activity. Yet, surprisingly, it is rarely examined in the literature on music and CWD (Després et al., 2021b). One of the few researchers to explore this topic, Wong (2015), Wong M. W (2021), and Wong M. W.-Y (2021) observed how teachers applied diverse teaching strategies to stimulate creativity in students with disabilities. For instance, they used adapted instruments (e.g., percussion instruments and gaming apps) and games (e.g., involving call and response, movement, and songs). The results showed that children are more creative when they have opportunities to play and explore, receive demonstrations and feedback, develop feelings of engagement, make choices, and obtain positive reinforcement. Unfortunately, researchers have largely ignored creativity in CWD. However, despite this lacuna in the music research, CWD—and all learners—would benefit from opportunities to express their creativity, and they deserve to have them. Therefore, concrete actions are urgently needed to provide the conditions for creativity to blossom, in all individuals, and across a diversity of settings and circumstances (Jeanne et al., 2019). In support of this argument, emancipatory studies that account for participant voice have helped individuals with disabilities become more autonomous and overcome barriers to social participation (Boucher, 2003; Cudré-Mauroux et al., 2020).

This article presents the results of a research project called the Extra-Ordinary Music Camp. The participants were children with intellectual and/or physical disabilities and/or learning disorders. We offered them an online distance learning program that brought together a medley of informal, inclusive, participatory, and adapted music activities. The overall aim was to help the children develop their musical, communication, and social skills.

Theoretical framework

Our theoretical framework builds on informal approaches to music education and was inspired by the customs of popular musicians. Informal music education approaches include six characteristics: (1) predominant use of listening and imitation as opposed to notation (Cope, 2002; Green, 2002); (2) emphasis on peer-to-peer and autonomous learning rather than the teacher–student relationship; (3) the simultaneous use of multiple musical skills: listening, interpretation, improvisation, and composition; (4) learner responsibility for learning, such as choosing their own instruments and repertoires; (5) learning mainly by ear, with the help of audio recordings; and (6) holistic and iterative assimilation of musical knowledge according to the learner's interests and musical development (Green, 2002, 2009). In addition to musical development, these characteristics foster autonomy, intrinsic motivation, and self-directed learning (Green, 2009; Davis, 2010). Thus, learners take ownership of their individual learning path, and as they overcome obstacles and enjoy successes along the way, they learn to self-assess their ability to achieve their own goals.

Few studies to date have addressed informal music education approaches in CWD (McHale, 2016; Rathgeber, 2017). This constitutes a serious gap in the knowledge on music education, especially when the above-mentioned characteristics of informal approaches appear to be highly suitable for fostering development in CWD. For example, strategies such as "sound before sight" and imitation involve experiential (as opposed to conceptual) learning, which is recommended for use with extra-ordinary[1] children (Westling et al., 2015). Moreover, informal strategies avoid the challenges of assimilating music theory and decoding music scores. Instead, they immerse learners directly into auditory-motor interactions (i.e., musical experiences) that lend themselves to a diversity of learning methods. In addition, these strategies can readily incorporate visual inputs (e.g., screens, books, and workbooks) that children are familiar with and that encourage them to discover and develop their strengths in other areas. Similarly, an assortment of informally organized musical activities (e.g., listening, interpretation, improvisation, and composition) allows multimodal learning, which is known for—among others—its positive impact on cognitive development in CWD (Côté et al., 2016). Furthermore, when attuned to learner interests and preferences, informal approaches promote motivation, engagement, and consolidated learning (Normand-Guérette, 2012). In addition, informal approaches imply a more horizontal partnership between teacher and child, which fosters reciprocity, learner initiative, and self-determination (Cudré-Mauroux et al., 2020). In sum, it would be highly worthwhile to gain a deeper understanding of the benefits of informal music education approaches for extra-ordinary children. Accordingly, we formulated the following research question: how can an informal music education approach contribute to the development of extra-ordinary children?

1 In the present study, *extra-ordinary* refers to children with intellectual and/or physical disabilities and/or learning disorders.

Objectives

To respond to our research question, we set the following objectives: (1) provide an adapted environment where extra-ordinary children could develop musical creativity; and (2) examine the impact of informal, inclusive, participatory, and adapted creative music activities on their development. This article presents the results related to the second objective, or the outcomes of participating in the Extra-Ordinary Music Camp in terms of communication, social skills, community use, musical skills, autonomy, and technology skills.

Methods

The initial blueprint for the Extra-Ordinary Music Camp was drafted in 2019, before the onset of the COVID-19 pandemic. The plan included additional music activities to those offered at 2 day camps in Québec City (Québec Province, Canada) (Després and Grenier, 2021). However, due to the pandemic-related sanitary measures in the summer of 2020, in-person attendance became impossible. Unwilling to drop or delay the project, we substantially reshaped it for online distance learning (Després et al., 2021a). The remodeled version consisted of informal synchronous online musical sessions delivered at a distance *via* Zoom. Importantly, the sessions were personalized: the participants co-constructed them according to their individual interests and musical skills. The camp ran for 7 weeks, from June to August 2020. The sessions lasted from 20 to 40 min, depending on the participants, and were delivered biweekly. The total duration of the program was adjusted to fit within the summer school break in Québec, and the lesson frequency was designed to strike a balance between accommodating the limited availability of the trainers and participants and maximizing the length of the intervention. The sessions were led by four trainers: students in the Faculty of Music at Laval University who were qualified in music education or instrumental pedagogy. The trainers formed dyads with the children. Notably, all the trainer–child dyads were maintained over the summer.

The educational program covered five activity categories: (1) **songs**, or oral expression activities (notably, the Extra-Ordinary Song, composed specifically for the study, featuring a personalized verse for each participant); (2) **a daily challenge**, to provide more demanding cognitive and motor activities, where the dyads focused on zones of proximal development and personalized goals (daily challenges were set at the start of each session, when the participants were usually the most amenable); (3) **motor activities**, such as moving to the rhythm of music, so the children could stretch, relax, and have fun after the daily challenge; (4) **creative activities**, where the children were encouraged to invent by improvising or composing vocal or instrumental music, or by moving to a musical rhythm; and (5) **relaxation**, with calming activities and rhythmic breathing to bring the session to a smooth close. Finally, the children were asked to appraise the session and name their favorite activities. As the sessions went on, the trainer–child dyads incorporated this feedback to co-construct more customized activities in the five categories.

The participants were also given musical instruments to use. The researchers and trainers initially selected relatively simple-to-use instruments that were suitable for distance learning as well as the limitations of video conferencing sound quality. The following instruments were chosen: melodica, Boomwhackers®, hand bells, slide flute, kazoo, and sticks and bucket (for bucket drumming). Before the sessions started, the instruments were

TABLE 1 Sociodemographic data for participants.

P	Gender	Age	Diagnosis
P1	M	8	Down syndrome with moderate intellectual disability (ID)
P2	F	14	Moderate ID
P3	F	8	Dravet syndrome, ASD (Level 2), sensory processing disorder, overall development delay
P4	F	15	Spastic quadriplegia (severe spastic cerebral palsy)
P5	F	14	ASD
P6	F	10	Right hemiparesis
P7	M	9	Down syndrome
P8	M	8	Spastic diparesis
P9	F	14	Down syndrome
P10	F	16	Down syndrome with ID
P11	M	12	Severe dyspraxia, dysarthria
P12	F	13	Down syndrome
P13	M	8	Down syndrome with ID
P14	M	13	Down syndrome, ASD, ADHD, severe language disorder
P15	M	9	Hypotonia
P16	F	16	Motor delay, verbal and motor dyspraxia, coordination acquisition disorder
P17*	ND	ND	ND
P18	F	17	Orphan disease, ASD, intellectual delay
P19	M	10	Moderate ID
P20	F	15	Mild to moderate ID
P21	F	17	ID
P22	F	17	Down syndrome with moderate ID
P23	M	12	Mild ID, language disorder, coordination acquisition disorder, ADHD
P24	F	12	Moderate ID, verbal and motor dyspraxia, ADD
P25	M	13	Mild ID, ADD, dyspraxia, dyscalculia, dysorthography

ND, Not determined.
*The parents of P17 chose not to complete the questionnaires, but they permitted the researchers to film their child during the sessions and to include the data for analysis purposes.

presented to the children and their parents, who selected them based on the children's interests and abilities. The instruments were then delivered to the families by about the fourth session. Some children opted to use their own musical instruments.

Participants

Once ethical research approval was obtained, we recruited participants *via* a poster distributed to several associations for parents of CWD in several regions of Québec Province. The participants comprised 25 children in six regions, aged 8–17 years. All the participants presented intellectual and/or physical disabilities and/or learning disorders. All the participants attended the sessions for the entire 7 weeks. **Table 1** presents the sociodemographic data for each participant.

Measurement tools

We used a mixed methods data collection approach. **Table 2** presents the measurement tools, respondents, and data collection times.

Video analysis

The principal researcher, co-researcher, and auxiliary researcher co-developed a video analysis grid. For each participant, four sessions were analyzed: session 1, the session after receiving the instruments (about session 4, according to the participants), the mid-point session (about session 7, according to the participants), and the last session (session 13 or 14, according to the participants). The analysis focused on five skill categories: (1) communication, (2) social skills, (3) musical skills, (4) autonomy, and (5) technology skills. Specific skills in each category were observed and assessed. **Appendix 1** presents the Observation Grid with the specific skills grouped under the five categories and the rating scale. A graduate student in Instrumental Pedagogy tracked the participants' individual progress in each skill from the initial to final session.

Adaptive behavior assessment system-II questionnaire

The Parent Form (Ages 5–21) of the Adaptive Behavior Assessment System-II (ABAS-II) questionnaire was used. The parents responded to three scales of the questionnaire: Communication, Community Use, and Social Skills. We selected a limited number of scales in order to minimize the time demands for the parents. The rating system was adjusted for the participants' individual trajectories through the program and for their specific needs and potential.

Results

This article presents the video analysis results for the music sessions, including the trainers' logbooks, as well as the results on the ABAS-II and the specifically developed questionnaire. The results for the group discussions with parents and the interviews with participants and trainers will be presented in a future publication (Després et al., 2022).

Video observations

Table 3 presents the improvements on the grid ratings for each participant from pre- to post-test. The synthesis of results is based on the data in this table and the trainers' logbook observations.

Communication

The specific skills in the communication category were spontaneous speech, receptivity to others, and response to questions. Five participants showed slight improvement in spontaneous speech. However, several participants ($n = 11$) who showed no change had presented good skills at the start. In terms of receptivity (i.e., look at the other speaker, listen, and take turns), one participant improved slightly, another regressed slightly, and 14 had good receptivity at pre-test. For response to the trainer's questions, ten participants showed either slight improvement ($n = 9$) or significant improvement ($n = 1$), while several participants ($n = 11$) had good response skills at pre-test.

Social skills

We assessed two specific social skills: engagement between trainer and child and compliance with requests. Engagement, or the ability to interact appropriately with another person (e.g., joke, laugh, compliment, greet, and thank), improved slightly or significantly in 19 participants, for the greatest improvement among all the skills. Compliance with requests improved slightly or significantly for half ($n = 12$) the participants but regressed in one participant: this child appeared to participate less during the second half of the camp, despite forming a close bond with the trainer.

Musical skills

Six specific musical skills were assessed: rhythmic, vocal, motor, auditory recognition, creativity, and score reading. The largest number of participants improved in rhythmic and motor skills: 18 showed slight or significant improvement. Vocal skills, assessed in terms of accuracy and placement, improved in 11 participants, with significant improvement for two of these. Only 17 participants were assessed for auditory recognition, and two of these showed slight improvement. Four participants improved significantly in creativity, and one improved notably. Four other participants improved in creativity, but only slightly.

TABLE 2 Measurement tools.

Instrument	Respondents	Data collection time
Sociodemographic questionnaire	Parents	Pre-test
ABAS-II questionnaire: Communication, Community Use, and Social Skills scales	Parents	Pre- and post-test
Specifically developed questionnaire with 3 scales: a) Communication b) Socioemotional development and engagement in music activities c) Participation in music activities	Parents and trainers	Pre- and post-test
Interview addressing 3 themes: a) Experience working with extra-ordinary children b) Perceptions of extra-ordinary children c) Perceived impact of the music activities on children's communication and social skills	Trainers	Pre- and post-test
Videotaped music sessions: 2 sessions/week for 7 weeks Videotape analysis by an auxiliary researcher using an observation grid	Children and trainers	During
Feedback on each session	Children and trainers	During
Discussion group addressing 6 themes: a) The camp in general b) The musical instruments used c) The online format d) Parental expectations and role e) Observed effects on the children f) Follow-ups to the Extra-Ordinary Music Camp	Parents	Post-test

Thus, creativity showed the most notable improvement for some participants. Three participants progressed slightly on score reading and two others showed significant progress. However, not all the participants worked on score reading, and only 11 were assessed for this skill.

Autonomy

We measured autonomy as the level of parental support required during the sessions and the participants' ability to take initiative and make decisions. Eleven participants presented slight ($n = 6$) or significant ($n = 5$) progress in autonomy, while eight showed slight ($n = 5$) or significant ($n = 3$) improvement in initiative and four improved slightly in decision-making.

Technology skills

Technology skills, or the ability to use computerized devices and Zoom, improved in nine participants, with slight and significant gains for seven and two participants, respectively. Some participants ($n = 6$) had good technology skills at the outset.

Adaptive behavior assessment system-II

The ABAS-II (Harrison and Oakland, 2003) is a standardized questionnaire used to assess the adaptive behavior and skills of individuals from birth to age 89. In this study, we used the Parent Form (Ages 5–21). The results were scaled according to the participants' chronological age. We ran various analyses of the results for each skill area (Communication, Community Use, Social) to determine changes from pre- to post-test.

Communication

The non-parametric Wilcoxon test showed no significant effect of camp participation on the variable *communication* from pre- to post-test ($Z = 0.66$, $p = 0.27$). Student's t-test or Wilcoxon's test were conducted on certain isolated variables to determine whether the *communication* items showed statistically significant improvement (e.g., "ends conversations appropriately" or "uses up-to-date information to discuss current events"). No statistically significant differences were found.

Community use

The variable *community use* refers to the ability to make use of resources in the community (e.g., walk or use a bicycle, shop, and go to a restaurant or park). Student's t-test for the whole sample revealed a statistically significant positive difference [$t(16) = 2.67$, $p = 0.008$] (i.e., improvement) for *community use.*

Social skills

Student's paired samples t-test obtained a significant positive difference between pre- and post-test [$t(16) - 2.09$, $p = 0.027$] for *social skills*. However, the confidence interval (95%) indicates that the mean difference for the population varies from −0.03 to 4.27. We cannot therefore conclude a significant positive difference for this skill category. Certain isolated items in the *social skills* category were tested to detect statistically significant differences. The item "says when he/she feels happy, sad, scared, or angry" revealed a significant positive difference

TABLE 3 Participant improvements according to the video analysis.

	Communication						Social skills				Musical skills												Autonomy						Technology skills		Total
	Spontaneous speech		Receptivity		Response to questions		Engagement		Compliance		Rhythmic		Vocal		Motor		Auditory recognition		Creativity		Score reading		Parental support		Initiative		Decision-making		Device and zoom use		
P1	0		0		1		1		1		1		0		1	+	0		0	+	0	+	1		0		N/A		1		7
P2	0		0	+	0	+	2		1		1		1		1		N/A		0	+	0		1		0	+	0	+	0		7
P3	0	+*	0		0		1		0		1		1		0	+	0	+	0	+	0		1		2		0	+	0		6
P4	0	+	0	+	0	+	1	+	0	+	0		0	+	2		1		0		N/A		0	+	0		0	+	0	+	4
P5	1		0		0	+	1		0		1		2		1		0	+	0	+	N/A		0	+	1		0	+	0	+	7
P6	0	+	1		1		2		1		1		2		0	+	0	+	2		N/A		0	+	0	+	0	+	1		11
P7	0		0	+	1		1		2		0		0		1		N/A		1		0		0		0		0	+	0		6
P8	0	+	−1		0	+	0		−1		1		0		1		0	+	0	+	1		0		0		0	+	0		1
P9	0		0		1		2		0	+	1		1		1		0		2		N/A		1		2		0	+	1		12
P10	1		0	+	0	+	2		2		0		1		2		0	+	3		N/A		2		1		1		0		15
P11	0	+	0	+	0	+	1		1		2		1		1		0	+	0		0		0	+	0		0	+	1		7
P12	0		0	+	0		1		0		1		0		0	+	N/A		0		0		0	+	0		0	+	2		4
P13	0		0		1		0		0		1		0		1		0		0	+	0		0		0	+	0	+	0		3
P14	0		0		0	+	0	+	1		1		0		2		0	+	0	+	2		0	+	0		0	+	0	+	6
P15	0	+	0	+	0	+	2		0	+	1		1		1		1		1		2		2		0		0	+	0		11
P16	0	+	0	+	0	+	1		0	+	1		0		0		N/A		0	+	N/A		1	+	0	+	0	+	0	+	3
P17**																															
P18	0	+	0	+	1		2		1	+	0	+	1	+	1	+	0	+	2		0	+	0	+	2		0	+	0	+	10
P19	0		0		1		1		0		0		0		0		N/A		N/A		N/A		2		0		0	+	1		5
P20	0	+	0	+	1		1		1		0		0		2		0	+	2		N/A		1	+	1		1		1		11
P21	1		0	+	0	+	2		2		1		0		2		0		1		1		2		1		0	+	2		15
P22	1		0	+	1		2		0	+	1		0		1		0		0		N/A		0		0		0	+	0		6
P23	0	+	0		0		0		0		2		0		1		0	+	0	+	N/A		0	+	0		0	+	0	+	3
P24	1		0	+	2		2		2		1	+	1		1		N/A		0		N/A		2		1		1		0		14
P25	0	+	0	+	0	+	0	+	1		1	+	1	+	0	+	N/A		1		1	+	0	+	0		1		1		7
Total	5		0		11		28		15		20		13		23		2		15		7		16		11		4		11		
Mean	0.21		0		0.46		1.17		0.63		0.83		0.54		0.96		0.12		0.65		0.54		0.67		0.46		0.17		0.46		
No. of participants that improved	5		1		10		19		12		18		11		18		2		9		5		11		8		4		9		

*The "+" indicates that the participant had good initial skills at the start of the camp.

**Because P17 participated in a limited number of music sessions, and always together with another participant, we did not analyze this participant's progress individually.

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using Student's paired samples *t*-test [$t(16) = 2.58$, $p = 0.01$]. In conclusion, the *social skills* scale shows no statistically significant differences overall, with the exception of the ability to express emotions.

Specifically developed questionnaire

Data for the specifically developed questionnaire were gathered as percentages, as presented below.

Communication

For the variable *communication*, non-parametric Wilcoxon's test revealed a statistically significant positive effect of the camp from pre- to post-test ($Z = 2.75$, $p = 0.003$).

Socioemotional development and engagement in music activities

Student's paired samples *t*-test showed no statistically significant difference for the variable *socioemotional development* [$t(16) = 0.54$, $p = 0.30$]. Some items in the *socioemotional development* and *engagement in music activities* categories were tested in isolation to determine significant differences, but no statistically significant improvements were found.

Participation in music activities

Student's paired samples *t*-test showed no significant differences from pre- to post-test for the variable *participation in music activities* [$t(16) = 0.76$, $p = 0.23$]. Individual tests for some items in this category showed no statistically significant improvements.

Discussion

The research objective presented in this article was to examine the impact of informal, inclusive, participatory, and adapted creative music activities on the development of extra-ordinary children. The results showed shared improvements across the measurement instruments for communication and social skills. Moreover, all participants improved on the measures for community use, musical skills, autonomy, and technology skills. In addition, they showed significant improvements in community use (ABAS-II) and communication (questionnaire specifically developed for this study).

Communication

The progress made in communication skills was mitigated according to the measurement instruments. The ABAS-II results showed improvements but no significant differences, whereas the specifically developed questionnaire obtained significant differences. Similarly, the video analysis results revealed generally positive changes, albeit less so for some participants and certain specific communication skills (e.g., receptivity). This inconsistency could be explained by several factors. First, the session observations showed that several participants already had good communication skills at the start of the camp, such that there was less progress to make. Furthermore, because the program was adapted for the children's individual interests and preferences, the time allotted to singing varied greatly across the participants. Hence, they did not benefit equally from the potential positive effects of singing on communication, such as better pronunciation (Joyner, 2021), vocabulary, and grammar (Busse et al., 2021). In addition, receptivity to the trainer varied greatly among the participants. This could be partly explained by their individual personalities and characteristics. For example, some CWD may find it harder to interact with unfamiliar people (Martin-Roy, 2019). Another factor would be the online distance delivery mode, which could have affected the participants in different ways. For instance, some participants found it easier to learn with a screen, which was especially helpful for holding their attention, whereas others were less comfortable with this medium. Similarly, some participants were more experienced with distance learning modes, having been previously exposed to synchronous online courses during the COVID-19 pandemic. In addition, distance music education courses preclude certain teaching approaches, such as the use of touch and other non-verbal strategies (Biasutti et al., 2021), which would be highly useful with more tactile-oriented children. Finally, we should note that the music sessions took place in the participants' homes, where the learning-support conditions varied widely, notably in terms of technology and Internet quality, the availability of quiet spaces free of distractions, the presence (or not) of siblings, and parental attendance during the sessions. It is important to keep in mind that children with intellectual or physical disabilities or learning problems tend to need assistance to maintain their attention and concentration during learning tasks (Westling et al., 2015). Thus, environmental factors that were most probably affected by the pandemic could have either helped or hindered their progress. On a further note, in the post-camp group discussions (results to be presented in Després et al., 2022), the parents reported that when the children used instruments such as the kazoo and discovered new ways to express themselves (e.g., singing, drumming, and dancing), they made gains in other communication areas as well, including spontaneous speech. Finally, it is worth mentioning that the participants' ongoing co-construction of the program combined with the post-session recaps encouraged them to make their voices heard throughout the program. Not only did they make their voices heard, they also saw that it actually counted and made a real difference in how the program was designed and run.

Social skills

The ABAS-II results showed no statistically significant improvements in social skills. Nevertheless, many authors have stressed the need to provide activities to help CWD develop communication and social interaction skills (notably, Abbeduto et al., 2007; Agran et al., 2016). Moreover, the ABAS-II results showed a significant increase in the use of community resources, which could create conditions that foster the development of social skills (Hall and Theron, 2016; Martin-Roy, 2019). Furthermore, the video analysis revealed improved social skills for many of the participants, particularly in terms of engagement with the trainer. Despite the distance learning setting and the fact that most of the children had not previously met their trainer in-person, they were able to form relationships in most of the dyads. This indicates that synchronous online distance learning programs can foster bonding between trainers and CWD. Several elements that were implemented during the sessions could have encouraged these interactions. For instance, as part of the ongoing co-construction process, the participants were asked for their feedback on the themes and songs. The trainers also offered the participants activity choices, which got them engaged and empowered them to make their own decisions. At the same time, many children had problems responding to the trainers' requests. This could be explained by several factors, including the children's fear of novelty, shyness, inability to understand instructions, lack of interest in some activities, over-excitement, and difficulty handling feelings (e.g., sadness and anger). To overcome these obstacles, the trainers tried a variety of teaching strategies. Among others, they used positive reinforcement, gave participants more decision-making power, broke the activities down into smaller steps, presented instructions one at a time to prevent cognitive overload, gave participants enough time to assimilate information, modeled tasks, used two-way and role reversal imitation (i.e., trainer and child take turns imitating each other), offered response choices, and used pictograms. This array of strategies helped the children follow routines and develop their musical skills.

Musical skills

Many of the participants improved in their musical skills, and particularly rhythmic and motor skills with instruments. The trainers used a mixture of teaching practices to foster rhythmic skills: teacher modeling and child imitation, slowly sung songs, and the development of alternative notations to associate images with rhythm (e.g., a squirrel = two black notes). In addition, the selected instruments could have contributed to improve motor skills through repeated use and the different hand and finger movements they required. The fact that the participants could keep their instruments at home during the camp also meant that they could practice and experiment outside the sessions, and extra-ordinary children need repeated practice in order to consolidate learned skills (Julien-Gauthier et al., 2018). Vocal skills, which we measured in terms of accuracy and placement, were more difficult to assess in this distance learning context, given the limitations of videoconferencing sound quality. Nevertheless, some practices appeared to be beneficial for working with vocal accuracy and placement, including associating everyday words with different note pitches, learning spoken words first followed by sung words, and playing the kazoo. Auditory recognition was developed mainly by recognizing instrumental sounds or ascending and descending notes. Little change was observed in this latter area, possibly because relatively few of the activities focused on this particular musical skill. Instead, the program emphasized multimodal activities that encouraged the children to produce and create music. Thus, the majority of the children worked on creativity, using two-way imitation games, creative movement activities, improvisation, music activities with images, and apps (especially GarageBand[2] and Incredibox[3]). A few participants showed significant ($n = 4$) and notable ($n = 1$) improvement in creativity, possibly because they were particularly interested in this aspect or due to the presence of individual factors that facilitated creativity. In addition, the trainers tended to use activities that elicited musical creativity. Finally, the children learned to read musical notes mainly with a special notation system (color-coded for pitch, shape-coded for note length) that the trainers co-developed as an alternative to the traditional notation system (i.e., notes on a musical score). This system appeared to help some participants learn to play the melodic instruments. However, it was not used with all the participants, either because it was a mismatch with their interests and needs, the instruments they used, or the activities they did, or because not all the trainers were keen on it.

Autonomy and community use

The participants demonstrated their autonomy by taking the initiative frequently during the sessions. For example, at the start of the camp, some of them did the activities that the trainer presented, but autonomously and at their own pace. Others set up their own graphics and animations for special performances. Interestingly, one participant composed a verse for the trainer at the end of the summer. Moreover, it is possible that the significant improvements measured on the Community Use section of the ABAS-II could be due to transfers of the gains in autonomy to daily life skills (e.g., neighborhood travel). A number of practices used during the camp seemed to bolster the participants' autonomy and

2 A music creation studio: https://www.apple.com/ca/mac/garageband/.

3 An intuitive music creation app: https://www.incredibox.com/.

initiative. The most conducive of these was gathering the participants' feedback after each session. This empowered them to choose activities and instruments and to act as a partner in the co-construction of the program. However, parental support, albeit good overall, sometimes came with drawbacks. When the parents were present, they usually facilitated communication between trainer and child. For example, when the trainers had trouble understanding what the children said, or when the children did not understand the trainers' instructions, the parents could step in and smooth the way. By witnessing these interventions, the trainers learned how to intervene in ways that were suitable for each child. For instance, they could use specific words that the children would understand. Unfortunately, the parents actually hindered the learning process at times, especially when they jumped in to "rescue" the situation without giving the children a chance to express themselves, follow the trainers' instructions, or try things on their own.

Technology skills

Although the parents performed many of the technology operations, some participants could manage by themselves. Some were already able to handle their devices and continued to do so throughout the project. Others picked up the skills as the weeks went on. Some also learned how to use more advanced features, such as using the Zoom Whiteboard,[4] switching the camera on and off, and moving the camera to make it easier for the trainers to observe (e.g., for sit-to-stand transitions).

Synthesis

In sum, for certain participants, the video analysis results for communication were corroborated by the communication results from the specifically designed questionnaire, while the results for social skills were corroborated by the ABAS-II scores for the item "says when he/she feels happy, sad, scared, or angry" and the results for autonomy were supported by a significant difference on the Community Use scale of the ABAS-II. In addition, the video results showed that the participants improved in their musical skills (particularly rhythmic and motor skills with an instrument) and technology skills, although these skills were not measured with other instruments.

Conclusion

The Extra-Ordinary Music Camp consisted of an exploratory study that aimed to examine the impact of informal, inclusive, participatory, and adapted creative music activities on the development of extra-ordinary children. The results show that the participants followed diverse and idiosyncratic trajectories. At the same time, all of them improved in the following areas: communication, use of community resources, social skills, musical skills, and technology skills. Thus, they demonstrated their ability to learn in a synchronous online distance program. Furthermore, they attended all the sessions. The combination of the informal approach and the educational program, co-constructed by the participants in an ongoing process, appears to have been a key factor for promoting development and autonomy in these children.

In conclusion, our results echo the findings of Rathgeber (2017), who showed that informal music learning approaches and inclusive learning spaces can enable *all* children to harness their strengths ("symbolic capital") and develop self-direction. Programs that offer a diversity of activities have been shown to motivate CWD, allowing them to broaden their technology and cognitive skills (Simonato et al., 2020). Hence, an assortment of short, dynamically linked activities can foster optimal attention in extra-ordinary children (Simonato et al., 2020). Moreover, in line with Theodorou and Drigas (2017), our results indicate that technology use fosters motivation in CWD. Thus, the synchronous online distance learning mode that we used for the camp appeared to help many of the participants maintain their attention for the length of the program. According to the trainers, this could be because the screen captures the eye and mobilizes selective attention (Després et al., 2022).

Limitations

Our results must be considered in light of certain limitations. First, the camp ran during exceptional times: the COVID-19 pandemic. The initial months of confinement were particularly disruptive for the daily lives of Québec families. Among others, there were major changes in work habits (the switch to teleworking and job loss) and family routines (e.g., cessation of school classes and day camps). Some individuals felt the effects of these changes more strongly (e.g., lack of stimulation, inadequate living space for full-time family life, and change-related stress). For others, the transformation turned out to be beneficial overall (e.g., greater availability of parents, schedule better matched with the biological clock, and less social pressure). Because the Extra-Ordinary Music Camp took place during this enormous upheaval, it was difficult to disentangle the effects of the two.

Second, we could not control for the diversity of either the participants or the intervention. The participants presented a heterogeneous profile that is characteristic of the population of children with intellectual and physical disabilities and learning disorders. These diverse interests and needs were

4 Zoom Whiteboard: https://it.lhric.org/zoom_whiteboard.

further compounded by the different personalities and academic pathways of the four student trainers, with their distinctive teaching styles and preferences. Consequently, the participants followed diverse trajectories in which certain skill areas were elicited more than others. Nevertheless, this diversity, which is representative of the profile of youth with disabilities (Westling et al., 2015) as well as most real-life scenarios, enabled observing a wide range of activities and teaching practices in what culminated in a broader, more versatile, and more inclusive program. In addition, the children's perseverance for the entire length of the camp, their obvious enjoyment of the sessions, and the positive feedback from the parents (Després et al., 2021a,c, 2022) attest to both the feasibility and potential of informal, inclusive, participatory, and adapted creative music activities delivered within a synchronous online distance program to support the development of extra-ordinary children.

Third, the measurement instruments varied in their ability to detect developmental changes, particularly given the heterogeneity of the participants and interventions combined with the short time-frame. For instance, using the ABAS-II, a standardized tool designed to assess adaptive behaviors in children, substantial changes would have to be measured over the relatively brief 7-week period in order to capture significant improvements. In contrast, the qualitative instruments (observations, interviews, and group discussion), which provided more fine-grained and individualized perspectives on the individual trajectories, revealed more specific changes from the standpoint of the project actors.

Fourth, due to the exploratory nature of this study, we did not use standardized tests to measure all the observed variables. This precluded triangulating the observational data on music and technology skills with the related quantitative data. Furthermore, we used a qualitative descriptive rating scale for the video observations. Although this provided a flexible and adapted perspective on each participant's trajectory, it presented limitations in terms of study replication.

Fifth, this study focused on communication and social skills, which are known to be essential for social participation. However, the camp program also included many activities designed to promote motor skills (dance, choreography, and improvisation) and cognitive skills (musical games, word learning, and music recognition) that were not measured by standardized observation or assessment instruments. Therefore, other program features, including the multimodal design, could have contributed to the overall development of the children who participated in our camp (Schlaug, 2015; Côté et al., 2016).

Finally, in light of the above limitations, the results of this study cannot be generalized to the heterogenous population of children with intellectual and physical disabilities and learning disorders. However, we believe that our flexible methodological approach was aligned with the participants' diversity, personal interests, and individual potential. As such, it fostered their engagement and gave them an opportunity to develop their musical skills and realize their creative potential.

Recommendations for future research

The Extra-Ordinary Music Camp demonstrated the benefits of an informal approach to music education using synchronous online distance delivery for children with intellectual and physical disabilities and learning disorders. Further studies in this direction could build on this experience to inform, design, and enrich teaching approaches and methods.

From an educational standpoint, the strategies that we developed[5] are readily applicable (e.g., activity lineups, alternative music notation systems, and lesson plans). More generally, our results also highlight the potential of creative multimodal approaches that account for learner voice to support music education in extra-ordinary children. The program for our music camp breaks new ground in the design of multimodal activities and underscores the value of children's feedback as they experiment with them. Due to its agility and responsiveness, the program can be co-constructed with the children, such that the sessions can be adapted to their own preferences, interests, and needs as time goes along. This empowers children's voice and strengthens their autonomy. Finally, due to the exceptional circumstances of the pandemic, we dropped our original measure for *inclusion* from the study. In this case, inclusion refers to the inclusion of children with and without disability in group activities. Future studies should investigate informal music education in mixed populations of children.

In terms of the methodology, further studies with larger and more diverse samples could account for subgroup characteristics, different teaching approaches, and other variables. It would also be informative to test long-term programs with repeated and follow-up measures. This would allow more precisely targeting minimum required durations for music programs to promote diverse development areas. Importantly, the measurement instruments should be differentiated and adapted for the participants according to their individual goals, needs, and interests. For example, a basic test battery could be used for the whole sample combined with specialized instruments drawn from a repository of established tests as needed, based on the participants' individual development and aspirations. In addition, interrater agreement on the video observation analysis would help offset the limitations of subjective rating and improve the potential for study replicability. Another promising avenue would be to examine the trainers' perspective, including their educational background, personalities, intervention methods,

5 Manuscript in preparation.

and impressions of the program. Finally, it would be worthwhile to explore the intrinsic value of sustained music practice for CWD and learning disorders.

Data availability statement

The datasets presented in this article are not readily available because dataset is not public. Requests to access the datasets should be directed to J-PD, jean-philippe.despres@mus.ulaval.ca.

Ethics statement

The studies involving human participants were reviewed and approved by the Comités d'éthique de la recherche avec des êtres humains de l'Université Laval (CÉRUL), Laval University. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin. Written informed consent was obtained from the minor(s)' legal guardian/next of kin for the publication of any potentially identifiable images or data included in this article.

Author contributions

J-PD, FJ-G, and CJ-I contributed to the conception and design of the study. CJ-I performed the statistical analysis. FB-B wrote the first draft of the manuscript. J-PD and FJ-G wrote sections of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Appendix 1

Video analysis grid.

Description of specific skills.

Communication	
Spontaneous speech	Vocabulary (V)
	Sentence structure and syntax (SS)
	Pronunciation (P)
Receptivity	Looks at the speaker (LaS)
	Listens to the speaker (LtS)
	Waits their turn (WT)
Response	Responds to questions (RQ)
Social skills	
Engagement	Ability to form a relationship (RA)
	Laughs/jokes (LJ)
	Gives compliments (GC)
	Politeness (P)
	Shows appreciation (SA)
Compliance	Compliance with trainer's requests (CR)
Musical skills	
Rhythmic	Musical beat (MB)
	Rhythmic Imitation (RI)
	Synchrony of sound and movement (SSM)
Vocal	Vocal accuracy (VA)
	Vocal placement (VP)
Motor skills with instruments	(MI)
Auditory recognition	(AR)
Creativity	(C)
Score reading	(SC)
Autonomy	
Parental support	(PS)
Initiative	Ability to initiate communication or actions (AI)
Decision-making	(DM)
Technology skills	
Device/Zoom use	(DU) (ZU)

Rating scale:

−1	Regression
0	No change
0 +	No change, with good skills at the start
1	Slight improvement
1+	Slight improvement, with good skills at the start
2	Significant improvement
3	Notable improvement