rijksuniversiteit groningen

Musical Experience in Primary School Children: Its Relationship with Musical Creativity and Autonomy Support

Jet I. Houter

Master Thesis - Talent Development & Creativity

S3998428

June 2024

Department of Psychology

University of Groningen

Examiner/Daily supervisor:

Dr. Henderien Steenbeek

A thesis is an aptitude test for students. The approval of the thesis is proof that the student has sufficient research and reporting skills to graduate, but does not guarantee the quality of the research and the results of the research as such, and the thesis is therefore not necessarily suitable to be used as an academic source to refer to. If you would like to know more about the research discussed in this thesis and any publications based on it, to which you could refer, please contact the supervisor mentioned.

Abstract

Creativity is nowadays seen as an important skill. One of the underlying mental processes is divergent thinking. Creativity emerges from the interaction between the actor, environment, and task. Not much is known about the child (actor) as the center focus of these interactions. Therefore, this research examines this by investigating the influence of musical experience on children's level of divergent thinking. Earlier research has linked musical experience to creativity. Furthermore, since the environment might stimulate creativity, the child-environment relationship was included by exploring the level of autonomy support given by an adult to children with and without musical experience. It was expected that children with musical experience showed higher levels of divergent thinking on a musical task compared to children without musical experience. The level of autonomy support was investigated exploratively. Videos of the participants (primary school children, $N = 12$, $M_{age} = 7.8$) performing a musical task with an adult were coded on the level of autonomy support and divergent thinking. A Monte Carlo analysis and visual inspection were performed on the coded data, complemented with a qualitative analysis. The results showed no differences for the level of divergent thinking between the groups. For autonomy support, the adult provided more instruction (low autonomy support) to children without musical experience. In general, the within-group differences were higher than the between-group differences. This research indicates that children might have different needs during a musical task to stimulate their musical creativity, which requires an adaptive, autonomy supportive approach by the teacher.

Keywords: Divergent thinking, creativity, primary school children, musical experience, autonomy support

Musical Experience in Primary School Children: Its Relationship with Musical Creativity and Autonomy Support

Creativity is seen as a powerful skill in many domains, like in the workforce (Lichtenberg et al., 2008) and in education (Kupers et al., 2019). Especially in arts education it is seen as an intrinsic value (Kupers & van Dijk, 2020). Creativity can increase children's self-esteem, motivation, and achievement (Koutsoupidou, 2008).

Aspects of Creativity

An idea or product needs to be novel, useful, and surprising before it is considered creative (Simonton, 2012). You can look at different strands to assess creativity, known as the 4P's of creativity (Rhodes, 1961). The strands are person, process, press (environment), and product. Much research has looked at static factors like the product to assess creativity (Kupers & van Dijk, 2020) but this study will focus on the process, following a dynamic systems approach (Kupers et al., 2019).

The Creative Process

Rhodes (1961) described the creative process as how someone produces ideas, focusing on motivation, perception, learning, thinking, and communication. However, the process does not only involve the person generating ideas. From the dynamic systems approach, the process is about how the interactions between the actor, their surroundings and the task influence the way creativity emerges (Kupers et al., 2019). According to this theory, creativity is not a latent trait but a concept that can change based on those interactions.

When looking at the creative process, often the term 'creative thinking' is used (Webster, 1990). Creative thinking can be divided into divergent and convergent thinking (Webster, 2002). Divergent thinking is about coming up with novel ideas via exploration, refining, and rejection of ideas. Convergent thinking is more linear and analytical by

weighing ideas and choosing the most suitable idea according to an emerging plan. Convergent thinking works best for well-defined problems (Gibson et al., 2009).

Creativity Development

There are certain personality traits and cognitive skills that influence individual differences in creativity (Gibson et al., 2009) but creativity is also influenced by developmental factors (Günzel, 2022). However, if you do not get the right opportunities to develop your creativity from an early age, you might lose your ability to be creative (Koutsoupidou, 2008). This makes it interesting to look at what factors might contribute to creativity development in children.

In educational research, the role of a teacher (press) in stimulating creativity has been investigated (Hendriks et al., 2023) but not a lot of research has looked at factors of the child (person) contributing to creativity. Therefore, this study examines the relationship between factors of the child and creativity. One of these factors might be musical experience (Fazaie & Ashayeri, 2018). By musical experience is meant that someone takes or has taken classes in playing an instrument.

Musical Experience and Creativity

Gaining musical experience has many benefits. On auditory, visual, and memory tests musicians outperform non-musicians (Silverstone, 2018). It has extra advantages at an early age because it helps children learn abstract concepts (Sungurtekin, 2021), words, and speak correctly (Silverstone, 2018).

Besides, there are indications that musical experience helps to become more creative. Ramón and Chacón-López (2021) found that children had more originality and more advanced use of musical elements in their musical products after multiple musical workshops. For children 8-9 years old the originality of their musical products improved the most compared to other creativity aspects. Originality is part of divergent thinking.

Not only originality is affected by musical experience. The 7-9-year-old children in the research of Fazaie and Ashayeri (2018) showed an increase in all measured creativity components (fluidity, flexibility, innovation, and expansion) after a three-month musical intervention. Comparable results are found in other age groups (high-school students and preschool children), where the children with musical experience scored higher on creativity measurements (Hallam, 2010).

Some aspects of musical experience might be more contributing to creative thinking development than others, like improvisation (Ramón & Chacón-López, 2021). Classes with improvisation stimulate creativity more than didactic classes (Hallam, 2010).

Music and the Brain

Why does musical experience relate to creativity? Part of the answer might be in neurology. Increase in creative thinking ability is associated with increased right lateral frontal segregation (Saggar et al., 2019). However, for the most productive and creative functioning, multiple large-scale brain networks through the whole brain need to interact (Duval et al., 2023). This is seen in research about performance on divergent thinking tasks: Creative people have bilateral prefrontal activity during these tasks whereas low-creative people show mainly left prefrontal activity (Carlsson et al., 2000). Similarly, musicians showed more bilateral activity during a divergent thinking task than nonmusicians and also performed better (Gibson et al., 2009).

So, musicians are better at divergent thinking than nonmusicians, but does musical experience influence someone's creativity? Musical training at an early age can lead to different brain development (Gibson et al., 2009). Many instruments require bimanual activity. Playing the piano for example requires both hands to play a different melody but when heard together it should feel like one piece. This might increase the interhemispheric interactions in the brain, reducing hemispheric asymmetry. In a two-year longitudinal study

with 6-year-olds, Habibi et al (2018) compared the brains of a musical group with a sports and control group. At first the brains of the groups did not differ. But after two years the brain structures of the musical group differed from the other groups, implying that the difference in the brains of musicians and nonmusicians is caused by their musical experience rather than biological dispositions. Therefore, it seems as if musical experience helps children to have better divergent thinking.

Musical Education

If musical experience helps children to become better at divergent thinking, it is important to examine how children can get experience. Not every child has the opportunity for out-of-school musical classes. Therefore, it is interesting to consider how musical experience can be gained at school. Many schools provide some musical education in their curriculums. The development of children's creativity is seen as an important objective in musical education (Koutsoupidou, 2008) as music teachers believe creativity is important for personal and social development (Sungurtekin, 2021). The teacher plays a vital role in stimulating creativity in educational settings (Kupers et al., 2019). A teacher needs to provide the right environment because the teaching environment relates to the brain networks associated with creativity in children (Duval et al., 2023). For example, Montessori children show more creativity and different brain network functioning than traditional-school children.

However, not every teacher knows how to give musical education in a way that stimulates creativity best (Kupers & van Dijk, 2020). A teacher can give convergent and divergent instructions. Divergent instructions are about leaving space for the student, encouraging the student to come up with possibilities, and asking open-ended questions. Convergent instructions are more instructive and informational. Divergent instructions are associated with more novelty in student's ideas. This is probably because a divergent instruction has more informational, noncontrolling teacher language, which enhances

creativity, whereas controlling language decreases creativity (Günzel, 2022). However, divergent instructions are much less used than convergent instructions (Kupers & van Dijk, 2020).

Teaching for Creativity: Autonomy Support

Teaching in a way that stimulates creativity is called 'teaching for creativity' (Kupers & van Dijk, 2020). When teaching for creativity there is a learned-centered approach in which students get choices and the teacher tries to accommodate to the student's needs. An important part of teaching for creativity is providing autonomy support (Hendriks et al., 2023). The feeling of autonomy has been linked to intrinsic motivation which is important for eliciting creativity. When providing autonomy support, teachers try to stimulate the internal motivation of the student by creating a pressure free atmosphere where the focus is on the student (Deci et al., 1994). This is done using behaviors like questioning, offering space for self-initiated action, explaining constraints, and giving positive feedback, which has similarities with divergent instructions.

Autonomy support can be divided into multiple categories (Hendriks et al., 2023). One of these is *creative autonomy support*, which is meant to give students 'ownership of the creative process'. For creative autonomy support in musical education, it is important to provide exploration time, observe, and listen to students.

This all gives the impression that to stimulate creativity, you need to give students much space to explore for themselves. However, only giving space and high autonomy is not eliciting creativity in every child (Kupers & van Dijk, 2020). A combination of an autonomy supportive and a more didactic, structured approach is probably the best to elicit creativity (Koutsoupidou, 2008). Before children can explore and show divergent thinking, they need to acquire skills and knowledge for the creative domain, for which more didactic, structured ways of teaching are often used (Kupers & van Dijk, 2020).

Providing structure can also be done in autonomy-supportive ways by using scaffolding techniques (Hendriks et al., 2023; Van de Pol et al., 2010). With scaffolding you give contingent support, meaning that the support is adapted to the needs of the child (Van de Pol et al., 2010). Furthermore, the support should gradually get less until the child takes over the responsibility for executing the task. The focus on the needs of the child is important, since some children need more structure from the teacher to come up with novel ideas than other students (Kupers & van Dijk, 2020). So, there is not a one-size-fits-all approach. However, there has hardly been any research on what contributes to the needs of a child.

Current Study

The current study will focus on children's musical creativity by looking at factors of the child, departing from a dynamic systems approach (Kupers et al., 2019). Two relationships will be investigated, dividing the research into two parts. The first part focuses on the child by looking at the relationship between children's musical experience and their level of divergent thinking. The second part focuses on the interaction between children and adults (environment) by investigating the relationship between the autonomy support of an adult and the musical experience of the child. The following research questions are formed:

1. *Is there a difference in the level of divergent thinking during a musical task between children with and without musical experience?*
2. *Is there a difference in the level of autonomy support given by an adult during a musical task for children with and without musical experience?*

For the first research question the hypothesis is:

Children with musical experience show a higher level of divergent thinking when performing a musical task compared to children without musical experience.

The second question will be investigated exploratively since there has been hardly any research on the relationship between musical experience and autonomy support.

Method

Participants

The participants (N = 12, M_{age} = 7.8) were selected from the data gathered by Hendriks et al (2023). They randomly selected 22 children (two per class, age 6-9) from five different primary schools in the north of the Netherlands.

For the current study, the selected participants were divided into two groups (Table 1). Six children played an instrument and were put in group 1 (musical experience, M_{age} = 8). Six other children were put in group 2 (no musical experience, M_{age} = 7.7). They were selected to match the variables (age, school, gender) of group 1 as much as possible. Musical experience was specified as playing an instrument. Students for whom part of the data was missing were excluded from the selection process.

Table 1

Participant Details

Group	Student	Grade and School	Teacher	Gender	Age
1	1	4 A	1	Female	8
	2	4 A	1	Female	8
	3	3 A	4	Female	6
	4	5 A	5	Female	9
	5	6 B	7	Male	9
	6	5 C	8	Female	8
2	7	4 A	2	Male	7
	8	3 A	3	Male	6
	9	5 A	5	Female	9
	10	4 B	6	Female	7
	11	6 B	7	Female	9
	12	5 C	8	Female	8

Design

The data collection consisted of video recordings of children performing a one-on-one musical task with the researcher of Hendriks et al (2023). The researcher was the same in every video. Teachers and parents of the students gave informed consent before the start of the study.

The task was done outside the classroom. Only the researcher and the child were in the room. The child was recorded from the front angle while doing the tasks, the researcher from the side or the front.

The task started with the researcher explaining that the child was chosen randomly from the class and what the aim of the task was. They then started with the tasks itself. Each child performed two musical tasks while the researcher guided and explained them.

The Cup-task

The first task is done with two pairs of cups. The child gets to choose the pair of cups they prefer (plastic or paper). Then the researcher shows how you can make sounds with the cups and shows a few rhythms the child has to copy. Afterwards they switch roles: the child has to come up with a rhythm and the researcher copies it. If the child wants to start with making rhythms, instead of the researcher, they will reverse the order of the task. This task mainly includes the musical aspects of rhythm and sound: A child can show creativity with the rhythm and different ways to use the cups to create sounds.

The Frog-task

For the second task, the child gets a wooden frog and stick (Figure 1) and is instructed by the researcher to try and make as many different sounds with the items as they can think of. The researcher lets the child explore and gives some guidance when needed. The musical aspects in this task are mainly sound, pitch, and volume as different aspects of the frog give different sounds, also influenced by how the stick is used. Creativity can be shown in the number of different ways to create sounds the child shows.

Figure 1

A Wooden Frog and Stick

The Researcher

The researcher aimed to provide exploration time for the child. Thus, focusing on providing autonomy support during the tasks. If the child needed more guidance, the researcher would give certain cues (for example: ‘What other body parts does the frog have?’) to help elicit new ideas in the child. Scaffolding techniques (Van de Pol et al., 2010) were used for the cues.

Procedure

Videos

Each child had a pre- and post-intervention measurement. For this study only the pre-intervention measurement of each child will be used because the intervention increased the musical experience of all children. So, using the post-intervention measurements would make the group difference for this variable smaller.

The total video of one child had an average duration between 8 and 16 minutes. About 4 to 7 minutes were for task 1, and 3 to 10 minutes for task 2. Parts of the video were analyzed for each child (see Appendix A).

Divergent Thinking

For the assessment of divergent thinking, the turns of the child will be coded. The non-verbal turns are the main focus of the coding because the tasks are about making music and exploring instruments. Therefore, most divergent thinking actions are non-verbal. Verbal actions are considered and used when they do not line up with the non-verbal actions.

However, most of the time the verbal actions are in line with the non-verbal actions and would therefore show the same amount of divergent thinking (for example, naming a new idea and trying it with the cups).

Autonomy Support

The autonomy support will be assessed by coding the turns of the researcher. For this the verbal turns will be the main focus. Most of the time the non-verbal expressions are supportive to the verbal expressions. It is therefore important to not only look at the content of the verbal expression but the whole picture including intonation, non-verbal expression and meaning to determine the level of autonomy support for the verbal turn. When a non-verbal turn is not related to or not on a similar level as a verbal turn, the non-verbal turn will be assessed on its own.

The Coding Process

For the analysis of the data, the videotapes of the child doing the tasks will be coded in Mediacoder (Bos & Steenbeek, 2017) using the manual with coding schemes (see Appendix A). The coding scheme for divergent thinking is based on the schemes of Kupers et al (2018), Hendriks et al (2023), and Potasse (2023). The coding scheme for autonomy support is based on the schemes for verbal and non-verbal autonomy support by Hendriks et al (2023). The original coding schemes were adapted to fit the research question and data of the current research.

In short, the coding process consisted of two steps. First the video was watched, and the coding periods were determined. Then, in the coding periods, every 10 seconds a code was given for the highest level of divergent thinking (5-point scale) and autonomy support (5-point scale) in that 10-second period. The scale consisted of four levels. Code 4 means the highest level; code 1 means the lowest level. A code 0 means the behavior shown was behavior that did not fit the variable's codes ('different behavior').

Coding Reliability

To assess the reliability of the coding scheme and the researcher, the intrarater reliability was calculated. The researcher coded two videos twice for each variable, using 1.5 minute of each task for each variable and video to meet the five-percent rule. The results of the two measurements were analyzed with a Monte Carlo simulation (Todman & Dugard, 2001) to determine the amount of conformity between both measurements and what the conformity would be if just taken the random chance. For the coding of divergent thinking, the conformity was .84 (84 percent) between the two measurements (Monte Carlo $p < .01$). For autonomy support this was .72 (72 percent, Monte Carlo $p < .01$). So, both variables had sufficient conformity, and this conformity was significant compared to the amount of conformity that would be found by random chance.

Method of Analysis

Monte Carlo Analysis

After the coding, a Monte Carlo analysis (Todman & Dugard, 2001) will be performed to answer both research questions. A Monte Carlo analysis is a non-parametric test that simulates a population distribution using the data of the sample. Hypotheses are tested by determining the probability a similar or better result than the observed results would be found in this simulated population (determining whether a difference in observed results is not just by chance). Therefore, this analysis can be used if the data does not meet assumptions needed for other tests (e.g., when the amount of participants is small or the data is dependent or not normally distributed). This analysis is chosen because the sample size in this research is small, and a Monte Carlo analysis gives the possibility to not only compare means between groups but also test other statistics.

For the first research question the level of divergent thinking for both groups will be compared, using a hypothesis $M_1 > M_2$. Also, the frequencies of the scores will be compared

because frequencies give more insight into the range and distribution of the scores observed. For codes 1 (imitation) and 2 (small variation) the hypothesis Group 2 > Group 1 will be tested. For codes 3 (large variation) and 4 (new idea) the hypothesis Group 1 > Group 2 will be tested. For the second research question, the mean level and frequencies for the scores of autonomy support for both groups will be compared. Since this is an exploratory question, these comparisons will be made based on the results and no hypotheses are tested.

The analysis will be done in Excel using an add-in with the Monte Carlo simulation function (Van Geert, 2020). The simulation will be run 10.000 times per test. Furthermore, since the 0-code is 'different behavior', a control analysis will be done. For this, a Monte Carlo analysis will be performed to check whether the groups differ significantly on the amount of 0-scores for each variable. If this difference is significant, it might distort the results because one group has significantly less codes with 'tested behavior' compared to the other group.

Visual Inspection

Additional to the Monte Carlo analysis, a visual inspection of the data will be done to get more insight into the distribution of the scores. The visual inspection will be done for both variables on the group and individual level of the participants. For the group level, the variability, peaks/valleys, and trends of the time series will be examined together with a comparison of the tasks. For the individual level, the individual time series will be compared to the average time series stating similarities and differences. Furthermore, the individual tracks will be compared to each other examining whether participants stand out based on variability, peaks/valleys, or amount of low/high scores.

Qualitative Analysis

Since the number of participants is relatively small, a qualitative analysis will be done too. This gives more insight into the process and nuances of divergent thinking and autonomy

support by investigating elements related to creativity distribution and originality expressions, and highlighting remarkable trends. For both variables, first a short group analysis will be given followed by a more detailed individual analysis. For divergent thinking, the group analysis will be describing whether children wanted to start with the cup-task, and whether the children thought much before exploring. For the individual analysis on divergent thinking, similar elements as the group analysis will be examined but in more detail, looking at: wanting to start, originality, verbal expression, ability to copy rhythms, and task difference. For autonomy support, on the group level general trends in verbal and non-verbal behavior of the researcher will be noted. In the individual analysis the general trends will be compared to the individual participants.

Results

Divergent Thinking

Descriptives

In Table 2 the means and frequencies of the codes for divergent thinking are shown for both groups. For group 1 (musical experience) the average of the scores is 1.72 and for group 2 the average is 1.83. When the 0-codes are excluded from the analysis, since this is the 'different behavior', the averages are 2.09 for group 1 and 2.14 for group 2. The amount of 0-codes does not differ significantly per group. So, the frequencies of the groups can be compared without a difference in 0-codes distorting the analysis.

Table 2

Means and Frequencies of the Codes for Divergent Thinking

Code	Group 1	Group 2	*p* (Group 1 > Group 2)	*p* (Group 2 > Group 1)
0	32	26	.24	-
1	76	69	.81	-
2	25	37	-	.06
3	4	6	-	.38
4	43	42	.50	-
Average	1.72	1.83	-	.26

Average without 0	2.09	2.14	-	.36

Monte Carlo Analysis

The average for group 2 (no musical experience) is higher than the average for group 1, as opposed to the hypothesis. So, testing $M_1 > M_2$ will give an insignificant result. Testing for a contrary result was also insignificant ($M_2 > M_1$: $p = .26$; $M_2 > M_1$ without 0: $p = .36$).

For the frequencies, it was expected that group 2 would score more codes 1 and 2, and that group 1 scored more codes 3 and 4. For codes 1 and 3 the results were contrary to the hypothesis and were therefore tested in the opposite direction. The p-values (Table 2) show there is no significant result for any of the frequencies tested. It is however interesting to point out the p-value .06 for code 2 (Group 2 > Group 1) as this is close to significant.

Visual Analysis

Group Analysis. Figures 2 and 3 show the time series for each group with the code for divergent thinking on the y-axis and the moment of coding on the x-axis. The variability seems higher in group 2 compared to group 1, since group 1 has a smoother line than group 2 ($p < .01$). Both groups show a peak at moment 16. This is because the frog-task starts at this point. The first thing a child tries with the frog is always a code 4 because the first idea is always a new idea.

For group 1, the trend follows a polynomial pattern with an increase until the peak at moment 16 and decline after this moment. For group 2, the trend is more horizontal linear with a slight decrease. So, the time series for the group averages show some similarities but also differ in the general trend and variability.

Task Comparison. The groups differ most on the first task (the cup-task, moments 1-15). Group 1 starts on a low level of divergent thinking and slowly builds up, whereas group 2 starts on a higher level of divergent thinking than group 1 and shows a slight decline in the

level of divergent thinking. For the second task (the frog-task, moments 16-30) both groups follow a decline. The decline for group 1 is more gradual than for group 2. So, for the tasks, the groups also show differences and similarities.

Figure 2
Divergent Thinking Average Group 1

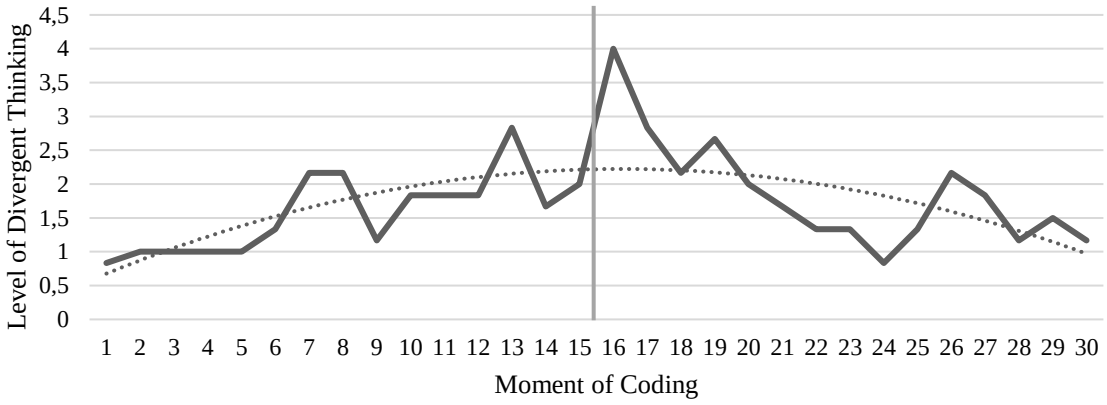
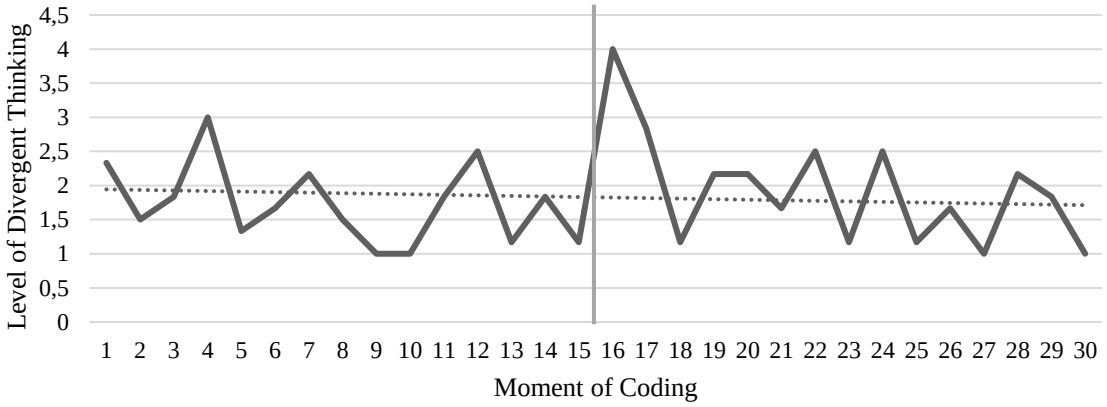


Figure 3
Divergent Thinking Average Group 2



Individual Analysis. Figures 4 and 5 show the time series for the individuals of both groups. Using visual inspection, these graphs support the peak at point 16 in both groups and the lower start of group 1 compared to group 2. Also, the children in group 2 show more variability between the time points than group 1, which is also found in the average time series for these groups. Besides that, the individual time series do not follow the average time series of the groups since there is much variability between the children and not a visible

general trend. So, the average time series do not represent the individual children of the groups. To get more insight into the differences between the average and the individual time series, the individual tracks of the children will be further examined (Figures 6, B1, and B2).

High and Low Values. It appears that some children show more high levels of creativity, whereas other children show more low levels. Participant F1 scores a 4 more often than other children in group 1 ($p < .05$) and in general (Figure 6, $p < .05$). F1 also is the only participant that does not score a 0 (Figures 4 and 5). Furthermore, in group 1, participant D1 seems to have the most low scores, with many 1-codes in the beginning and end of the time series. However, this difference was insignificant, but close to significant (Figures 6 and B1D, $p = .06$). In group 2 it is less clear if there are children showing more high or low levels of divergent thinking compared to the other children of group 2 (Figure 6).

Variability. The variability of the individual tracks is higher in group 2 than in group 1 (Figures 4, 5, B1, and B2, $p < .01$). Where all participants in group 1 have a time where they spend 4 or more consecutive moments on one level, this is not so much observed in group 2. Especially participants E2 and F2 of group 2 show big increases and decreases between time points (Figure B2).

Figure 4

Divergent Thinking Group 1

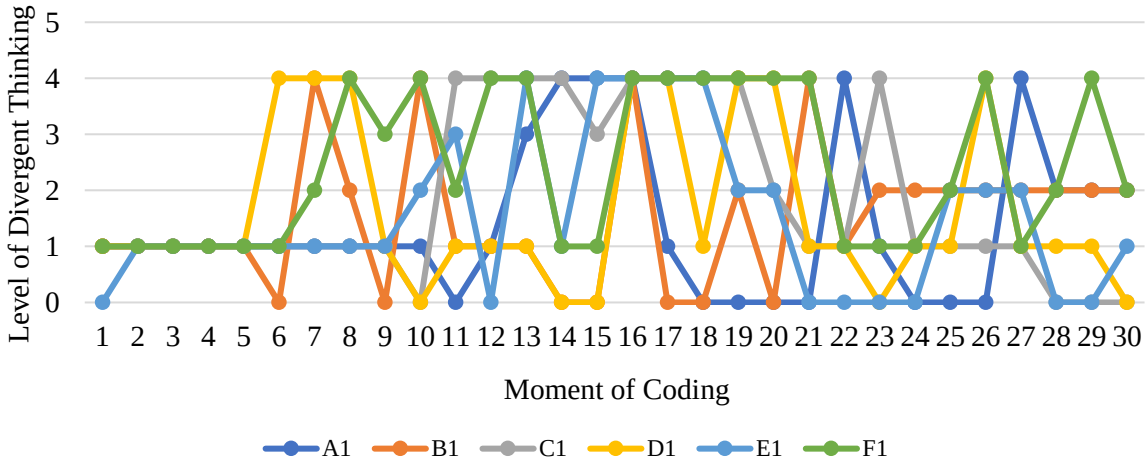


Figure 5

Divergent Thinking Group 2

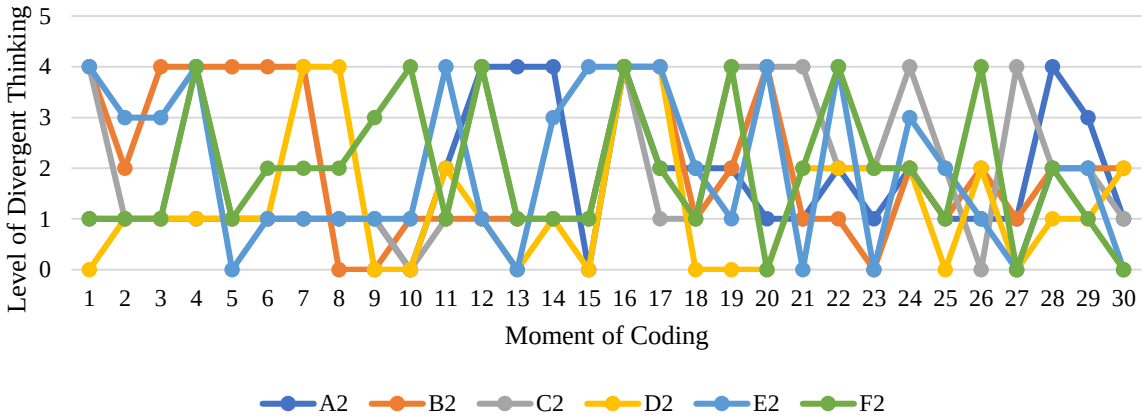
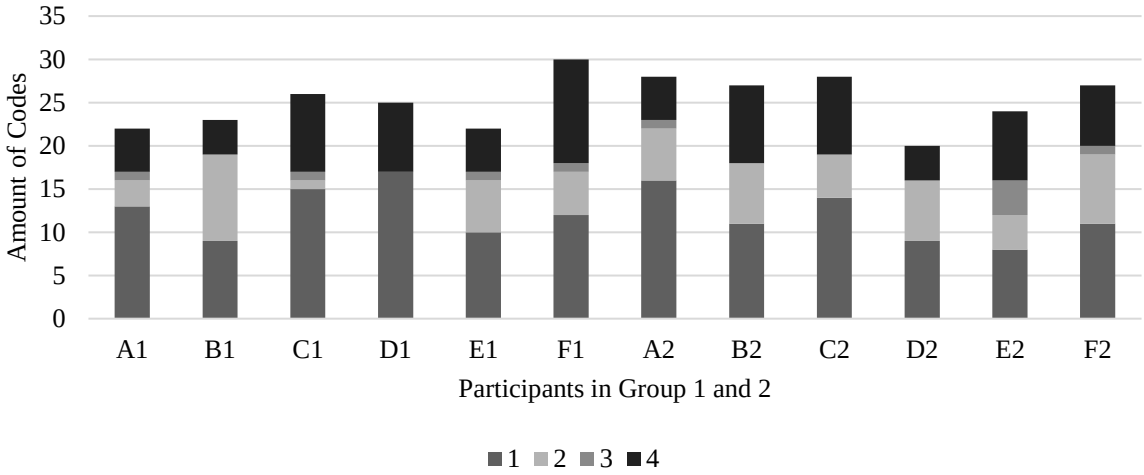


Figure 6

Distribution of Scores for Divergent Thinking per Individual



Note. The numbers in the legend represent the codes 1 to 4.

Qualitative Analysis

Group Analysis.

Start. In group 1 the children wanted the researcher to start making rhythms that they could copy and switched roles later. This is in line with the low level of divergent thinking at the start of group 1 and the increase during the task (Figure 2). In group 2, three children wanted to start making rhythms in the cup task. They switched to imitating the researcher

later in the task. This is in line with group 2 starting higher on the level of divergent thinking and the slight decline during the task (Figure 3).

Exploration and Thinking Time. In both groups there are children that tried many things and children that did not. Some children needed more time to think before they tried something new, while others started to actively explore and try ideas out. In the individual graphs, this thinking time is seen by a high variability going from 0-codes at one moment to higher levels of divergent thinking the next moment (Figures B1 and B2). This is especially visible for participants in group 2. These differences will be explained more in the individual analysis.

Individual Analysis.

Start. A difference between the groups is that in group 2 three children wanted to start in the cup-task (participants B2, C2 and E2) and in group 1 none of the children wanted to start.

Originality. Some children showed more originality in their ideas than other children. The level of originality differs per participant. Some participants try new rhythms using the examples from the researcher (most participants), whereas other participants introduce ways to make sounds that the researcher has not shown yet (C1, F1, A2, B2, E2). Participants C1, E2, and F2 got so creative, it was hard for the researcher to copy rhythms (e.g., participant E2 clapped her hands and moved the cups all over the table). They sometimes scored imitation because the researcher asked them to repeat their own rhythms.

There are also children who did not show much originality (A1, B1, D1, E1, C2, D2). These children often needed more suggestions from the researcher to come up with ideas than the children with high originality. The reasons for their lower originality differ, examples will be provided in the following sections.

Exploration and Thinking Time. In general, the children with high originality needed less thinking time and used more time to actively explore ideas. In contrast to that, the

children with lower originality often had more thinking time and got more suggestions from the researcher (e.g., participants B1, C2, and D2).

However, the general observations do not apply to every participant. For example, participant D1 did try a lot but the things she tried did not differ much. Also, participant E2 showed high originality but had much thinking time before expressing new ideas, which is also clear from the extreme fluctuations in the time series (Figure B2E).

Verbal Expression. Some children appeared somewhat shy (A1, B1, C2, D2), whereas other children expressed many of their thoughts verbally (E1, B2). For example, participant E1 verbalized not having any ideas by saying 'I do not think there's anything else to do with this' after exploring the wooden frog for a brief time. Participant B2 also verbalized many of his thoughts (e.g., 'I am going to hit every part of the frog and see what sound it is.' but also reactions like 'aah' when he heard a new sound.).

There were also some more shy children who did express themselves. Participant D2 indicated not having any ideas left after trying a few things. Participant A1 asked a lot of questions and expressed ideas verbally, trying most of them only when the researcher asked her to.

Ability to Copy. There are some children who had difficulty copying rhythms from the researcher (E1, A2, B2). On the other hand, participant F1 was good at copying rhythms, even more difficult ones.

Task Difference. The divergent thinking of the children is sometimes task dependent. Participants E2 and F2 showed high divergent thinking with the cups but did not with the frog-task. They needed many suggestions to think of ideas during the frog-task, whereas they did not need as many during the cup-task.

Autonomy Support

Descriptives

Table 3 shows the means and frequencies of the codes on autonomy support for both groups. The average scores of the groups are 1.96 for group 1 and 1.93 for group 2. Code-0 is again the ‘different behavior’. The means without this code are 2.89 for group 1 and 2.76 for group 2. The p-value for the 0-codes is insignificant, meaning that the frequencies 1 to 4 can be compared between the groups.

Table 3

Means and Frequencies of the Codes for Autonomy Support

Code	Group 1	Group 2	*p* (Group 1 > Group 2)	*p* (Group 2 > Group 1)
0	58	54	.36	-
1	8	18	-	< .05
2	43	39	.35	-
3	26	24	.56	-
4	45	45	.54	-
Average	1.96	1.93	.46	-
Average without 0	2.89	2.76	.16	-

Monte Carlo Analysis

For the analysis of autonomy support no hypotheses were formed because this variable will be exploratively investigated. When comparing the average level of autonomy support of both groups, there is not a significant difference ($M_1 > M_2$: $p = .46$; $M_1 > M_2$ without 0: $p = .16$). The only significant difference is that group 2 scores more 1-codes than group 1 ($p < .05$). This indicates that for children without musical experience the researcher gives instructions more often than for children with musical experience.

Visual Analysis

Group Analysis. Figures 7 and 8 show the time series of the average amount of autonomy support for both groups with the code for autonomy support on the y-axis and the moment of coding on the x-axis. The variability is higher in group 2 compared to group 1 ($p < .05$). In general group 2 has more strong peaks and valleys than group 1.

Both groups have an increasing linear trendline. For group 1 the trend is steeper, ranging from approximately 1 to 3, whereas the trend for group 2 ranges from approximately 1.5 to 2.5. So, the trends of the groups are somewhat similar, and the variability is the biggest difference between the groups.

Figure 7

Average Autonomy Support Group 1

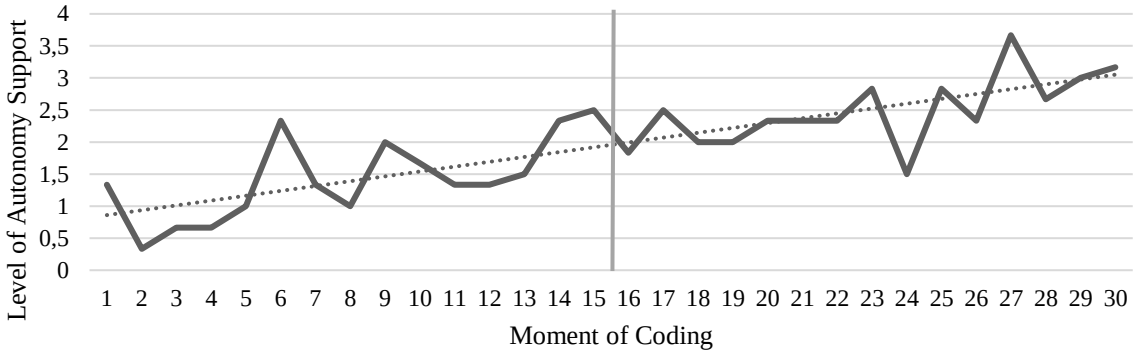
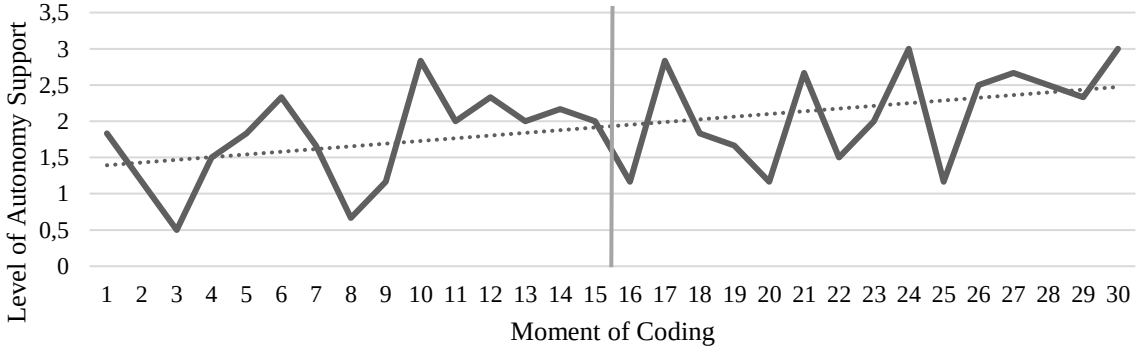


Figure 8

Average Autonomy Support Group 2



Individual Analysis. Figures 9 and 10 show the individual time series of the autonomy support given by the researcher for the participants in each group. These figures clearly show there is much variability between the individual tracks of autonomy support. Also, not all participants have an autonomy support track that follows a pattern similar to the trendline of the group. In group 1, only for participants A1 and F1 the autonomy support follows a pattern somewhat like the average group 1 pattern (Figure B1), with low levels in the beginning and

high levels at the end. For the other participants, the researcher has a trajectory of autonomy support that does not follow the trendline (Figures B1 and B2).

High and Low Values. For most codes there is not one participant that got that code remarkably more or less than the other participants (Figure 11). In group 1, participants A1 and B1 seem to have gotten the most 4-codes (Figure 11), whereas participants D1 and F1 received more medium levels of autonomy support (code 2). In group 2, participant A2 seems to have gotten the most 0-codes (Figure B2A) but also the most 4-codes together with B2 and D2 (Figure 11). Furthermore, in general, the 'low' code (code 1) is observed less than the other codes.

Variability. The variability of the individual tracks is higher in group 2 than group 1 ($p < .05$). In both groups, the trajectories of autonomy support for the participants differ, showing high variability between the participants. Based on visual inspection, the variability seems to be higher for some participants (B1, E1, and most participants in group 2 [Figures B1 & B2]) compared to the others. That most participants in group 2 have a high variability for autonomy support is in line with the average variability in this group being higher than group 1.

Figure 9

Autonomy Support Group 1

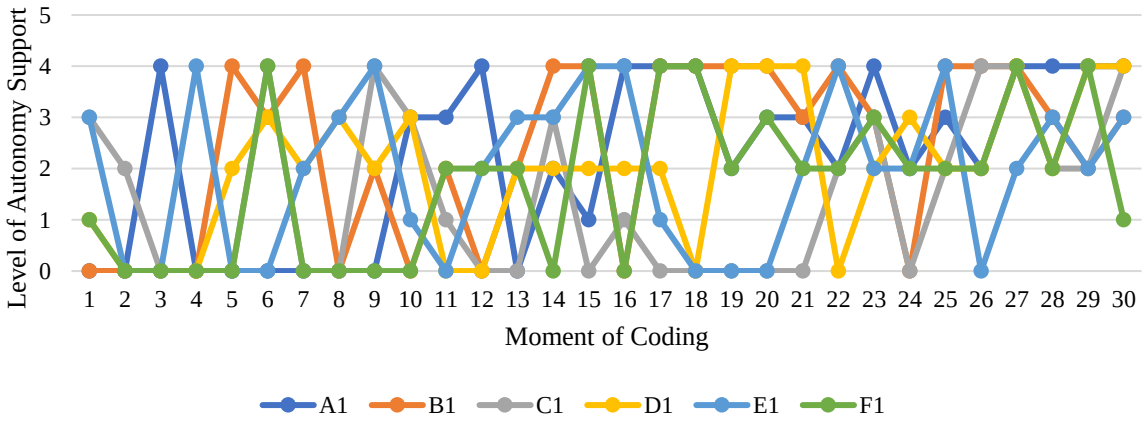


Figure 10

Autonomy Support Group 2

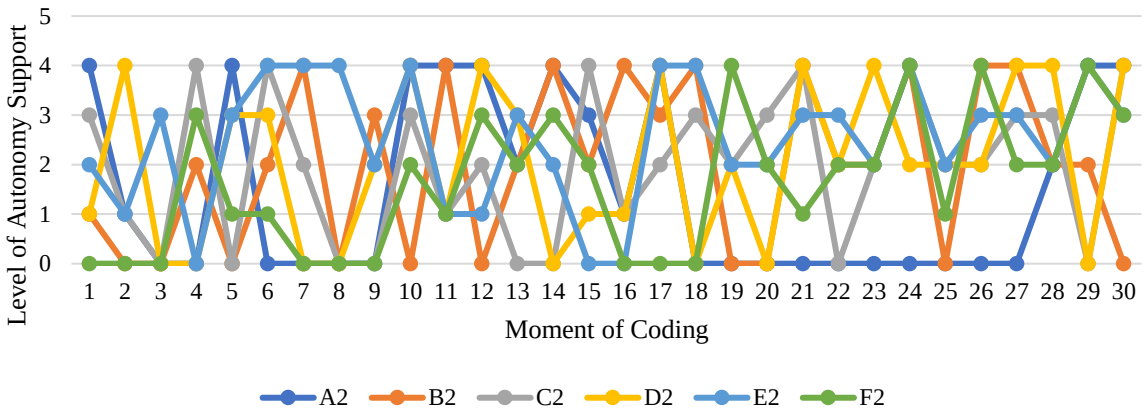
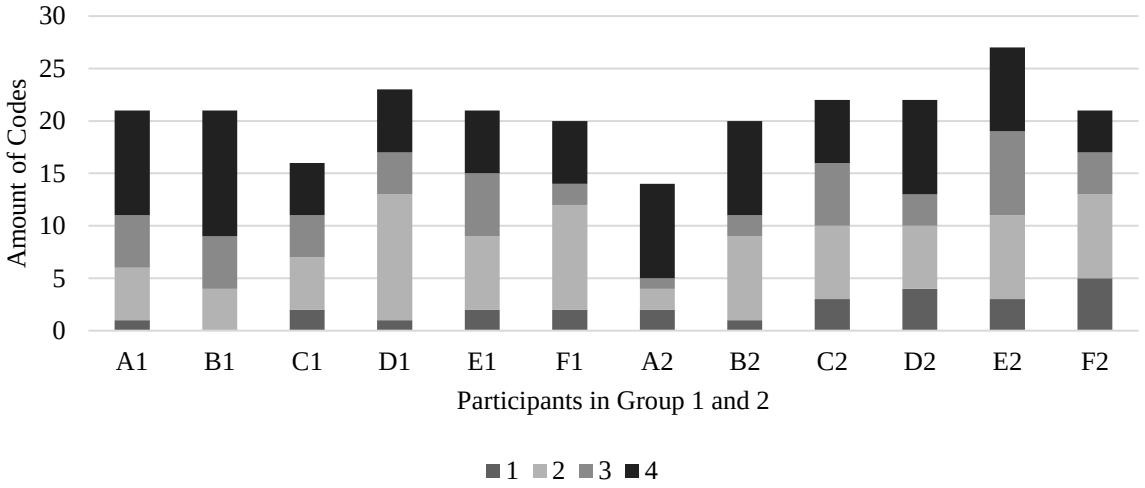


Figure 11

Distribution of Scores for Autonomy Support per Participant



Note. The numbers in the legend represent the codes 1 to 4.

Qualitative Analysis

Group Analysis. During the tasks, the researcher scored a lot of 0-codes. During these moments, a certain kind of behavior was observed: The researcher had a neutral, open facial expression and looked at what the child did. The child could explore on its own during these periods. The researcher did not say anything nor showed any verbal signs indicating emotions or reactions.

For the other levels of autonomy support, the researcher reacted to the actions of the child. When a child was out of ideas, asking questions or kept doing the same thing, she intervened to help the child think of new ideas. This was usually done going from higher levels of autonomy support to lower levels until the child came up with an idea. An example of a higher-level suggestion is: 'What else can you do with the stick?'. A medium-level suggestion could be: 'What other body parts does the frog have?'. An example of a low-level suggestion is: 'If you pick up the frog, you can also touch its belly.' When autonomy support was offered, and the child tried something new, the researcher often responded with a compliment (code 4).

Individual Analysis. The researcher provided higher levels of autonomy support for some children compared to others. For example, for participant A2, the researcher showed almost only high (code 4) or code-0 behavior (Figures 11 and B2).

For participant F2 the adaptation of the researcher to the actions of the child is clearly visible from moment 19 till 30 (Figure B2F). The autonomy support and divergent thinking start at the highest level but when the divergent thinking level decreases, the level of autonomy support decreases afterwards and goes up again when the level of divergent thinking increases.

It seems the individual differences in the autonomy support the participants received from the researcher are based in the need for autonomy support a child has because the researcher responded to the child's actions. Some children start actively exploring and do not need many suggestions from the researcher (C1, A2, C2, D2), whereas other children need suggestions to come up with new ideas (A1, B1, D1, E1). There are also children who need more suggestions for some tasks but not for others (F1, B2, E2, F2). B2 needed help with copying rhythms, and F1, E2 and F2 needed help with the frog but not with the cups.

Discussion

This study focused on the difference in the level of divergent thinking and autonomy support between children with and without musical experience when performing a musical task. This was tested using qualitative and quantitative measures, examining differences on the group- and individual level. The results on divergent thinking did not support the hypothesis that during a musical task, children with musical experience show higher levels of divergent thinking than children without musical experience.

The means and frequencies of the levels of divergent thinking for both groups did not differ significantly, meaning there is not one group scoring higher levels of divergent thinking than the other. However, contrary to the hypothesis, children without musical experience scored close to significantly more small variation (code 2) and one participant with musical experience scored more new ideas (code 4) than the other children.

There is, however, a difference in the distribution of the high scores over time, as the visual inspection of the time series showed. For children with musical experience the average time series is smoother with a peak in the middle, whereas the average time series for children without musical experience is more horizontal with high and low levels spread evenly over the whole period. This is in line with the higher variability (on group- and individual level) for children without musical experience because their slope showed bigger increases/decreases in the level of divergent thinking between consecutive time periods. However, the individual patterns of the participants did not follow the average time series.

The qualitative analysis supports the finding that individual patterns do not follow the trend of the group. For most qualitatively inspected elements (originality, exploration and thinking time, verbal expression, and ability to copy), each group had high and low scoring participants. The only differences were in the desire to start the cup-task (half of the children without musical experience, and none of the children with musical experience wanted to start) and the task difference (only for a few children without musical experience there was a

clear difference between the tasks). So, summarizing these analyses, the within-group differences are higher than the between-group differences, therefore, not supporting the hypothesis.

For autonomy support provided by an adult there was no hypothesis to be supported or discarded since this was investigated exploratively. The statistical test for the means and frequencies showed the only significant difference is that the researcher provided more instruction (code 1) to the children without musical experience than to the children with musical experience. There are no specific children for whom the autonomy support stood out.

The visual inspection showed that the time series of the groups are quite similar, except for children without musical experience the researcher showed more fluctuations around the trendline because of the higher variability for this group (on group and individual level). Again, the individual patterns do not resemble the group average.

The qualitative analysis showed that, in general, the researcher adapted the level of autonomy support to the needs of the child, which indicates the use of scaffolding techniques (Van de Pol et al., 2010). This probably resulted in differences between the level of autonomy support given to the children because of differences in children's needs.

Summarizing these results, also for autonomy support the within-group differences are bigger than the between-group differences, with the only clear between-group differences being variability and the adult providing more instruction to children without musical experience.

Interpretation of Results

The following section will provide some possible explanations for the results. First, a look will be taken at the within-group differences being bigger than the between-group differences. For this, the child and environment elements of the dynamic systems approach will be used (Kupers et al., 2019). First, a factor of the child that might have influenced the

results is personality (Gibson et al., 2009) because creative ability is a combination of innate and developmental traits (Günzel, 2022). Neuroticism is related to less creativity, whereas characteristics like openness, extraversion, IQ, and competence are related to more creativity (Asquith et al., 2022; Grajzel, 2023; Krumm et al., 2018). Since this research did not investigate or control these variables, they might have influenced the results.

Another factor of the child might be their experiences: The influence of experience on creativity might be more nuanced than just musical experience. First, the kind of musical experience a child has matters. If the musical classes consisted of improvisation exercises, the chances of the child showing increased creative ability are higher (Hallam, 2010; Ramón & Chacón-López, 2021). Second, creative hobbies (like art) also positively relate to creativity (Asquith et al., 2022). So, there could be multiple factors besides or within musical experience that resulted in the high within-group differences and nonsignificant between-group differences.

Another explanation has to do with the environment. With code-1 for autonomy support being the only significant frequency difference, it seems the children without musical experience needed more instructions to get to the same level of divergent thinking as the children with musical experience. This is in line with the research by Kupers and van Dijk (2020) showing that children need to get tools before they can creatively explore. The children with musical experience probably already had these tools because of their musical experience, whereas the children without musical experience did not and therefore needed the instruction.

Another result to be considered is the higher variability for children without musical experience. For divergent thinking this might partly be because there are more participants without musical experience that needed more thinking time and that were asked to repeat their own original rhythms. For autonomy support it might have to do with individual

differences in the need for autonomy support, leading to more or less scaffolding by the researcher.

Strengths and Limitations

This research has a few strengths and limitations that will be highlighted in this section. First, the small sample size made it possible to deeply investigate the variables through multiple angles and analyses. Furthermore, the researcher had experience with the use of autonomy supportive techniques. Therefore, it's possible to compare the autonomy support and divergent thinking of the children as the researcher is a constant, reliable factor. A practical limitation for this strength is that teachers often have less experience with these techniques, making it less realistic that in practice similar results to this research would be found.

Another limitation of the research is that musical experience was not related to a certain amount of musical experience. Therefore, children that just started classes and children that had classes for a longer time were all put in the musical experience group.

Lastly, the researcher sometimes asked children to repeat their rhythm because the researcher could not copy it at once. This resulted in more imitation scores for some children, even though it wasn't their own idea to imitate. In next research, this might be considered when making a coding scheme.

Future Research

This study gives a few interesting angles for future research. First, this study did not investigate the interaction between autonomy support and divergent thinking. However, the results give the impression there might be an interaction because of the same level of divergent thinking but difference in instruction provided by the adult between the groups. From dynamic systems theory (Kupers et al., 2019), an interaction is also suspected because according to this theory creativity (divergent thinking) emerges from the interaction between

the environment (autonomy support), the child (musical experience) and the task (musical task), making it interesting to examine this relationship in future research. Additionally, factors contributing to children's need for autonomy support can be further explored, as personality and type of creative experience might be of influence.

Furthermore, children without musical experience scored close to significantly more small variation (code 2) than children with musical experience. Even though this research does not give a significant effect, it is worth further investigating this in future research because in this study the difference in autonomy support between the groups might have compensated for a difference in divergent thinking. So, without a difference in autonomy support there might be a difference in divergent thinking. It is worth investigating this by replicating this study with primary school teachers because in practice not all teachers are equally proficient at providing autonomy support to their students (Kupers & van Dijk, 2020). Therefore, they might not be able to compensate for a difference in divergent thinking between the groups.

Practical Implications

This research implies that children with and without musical experience can be equally creative on a musical task. It is however suspected that children with musical experience need less instruction to be musically creative than children without musical experience. Furthermore, each child has its own process while performing a creative task. So, there might not be a one-size-fits-all way of instruction that works best, and teachers should adapt their way of instructing to a child's need, for example by using scaffolding techniques (Van de Pol, 2010). It is therefore important to train teachers in providing autonomy support adjusted to children's needs because many teachers don't know how to do it (Kupers & van Dijk, 2020) and it is something that can be learned (Hendriks et al., 2023).

Conclusion

This research showed there is not a clear difference in the level of divergent thinking between children with and without musical experience, as the within-group differences are bigger than the between-group differences. The same goes for the level of autonomy support provided by an adult. Only, the adult gave more instruction to children without musical experience, which might be related to not finding an effect for the level of divergent thinking.

References

Asquith, S. L., Wang, X., Quintana, D. S., & Abraham, A. (2022). Predictors of creativity in young people: Using frequentist and Bayesian approaches in estimating the importance of individual and contextual factors. *Psychology of Aesthetics, Creativity, and the Arts, 16*(2), 209–220. https://doi-org.proxy-ub.rug.nl/10.1037/aca0000322.supp (Supplemental)

Bos, J., & Steenbeek, H. (2017). Mediacoder [Software]. University of Groningen. https://mediacoder.gmw.rug.nl

Carlsson, I., Wendt, P. E., & Risberg, J. (2000). On the neurobiology of creativity. differences in frontal activity between high and low creative subjects. *Neuropsychologia, 38*(6), 873–85. https://doi.org/10.1016/S0028-3932(99)00128-1

Deci, E.L., Eghrari, H., Patrick, B.C., & Leone, D.R. (1994). Facilitating internalization: The self-determination perspective. *Journal of Personality, 62*, 119-142. https://doi-org.proxy-ub.rug.nl/10.1111/j.1467-6494.1994.tb00797.x

Duval, P. E., Fornari, E., Décaillet, M., Ledoux, J., Beaty, R. E., & Denervaud, S. (2023). Creative thinking and brain network development in schoolchildren. *Developmental Science, 26*(6). https://doi-org.proxy-ub.rug.nl/10.1111/desc.13389

Fazaie, S., & Ashayeri, H. (2018). The impact of music education on 7-9-year-old children's creativity in Tehran. *Iranian Journal of Psychiatry and Clinical Psychology, 24*(1), 16–29. https://doi-org.proxy-ub.rug.nl/10.29252/nirp.ijpcp.24.1.16

Van Geert, P. (2020). Paul's functions [excel add-in for statistical analysis].

Gibson, C., Folley, B. S., & Park, S. (2009). Enhanced divergent thinking and creativity in musicians: a behavioral and near-infrared spectroscopy study. *Brain and Cognition, 69*(1), 162–9. https://doi.org/10.1016/j.bandc.2008.07.009

Grajzel, K., Acar, S., & Singer, G. (2023). The Big Five and divergent thinking: A meta-

analysis. *Personality and Individual Differences, 214*, 1–10. https://doi-org.proxy-ub.rug.nl/10.1016/j.paid.2023.112338

Günzel, A.M. (2022). *Curiously creative: The relationship between teacher verbal autonomy support and convergent musical creativity in primary school aged children* [unpublished master thesis]. University of Groningen.

Habibi, A., Damasio, A., Ilari, B., Veiga, R., Joshi, A. A., Leahy, R. M., Haldar, J. P., Varadarajan, D., Bhushan, C., & Damasio, H. (2018). Childhood music training induces change in micro and macroscopic brain structure: Results from a longitudinal study. *Cerebral Cortex, 28*(12), 4336–4347. https://doi-org.proxy-ub.rug.nl/10.1093/cercor/bhx286

Hallam, S. (2010). The power of music: Its impact on the intellectual, social, and personal development of children and young people. *International Journal of Music Education, 28*(3), 269–289. https://doi-org.proxy-ub.rug.nl/10.1177/0255761410370658

Hendriks, L., Steenbeek, H., Bisschop Boele, E., van Geert, P et al (2023). Promoting creative autonomy support in school music education: An intervention study targeting interaction. *Frontiers in Education.* https://doi.org/10.3389/feduc.2022.1102011

Koutsoupidou, T. (2008). Effects of different teaching styles on the development of musical creativity: Insights from interviews with music specialists. *Musicae Scientiae, 12*(2), 311–335. https://doi-org.proxy-ub.rug.nl/10.1177/102986490801200207

Krumm, G., Lemos, V., & Richaud, M. C. (2018). Personality and creativity: A study in Spanish-speaking children. *International Journal of Psychological Research, 11*(1), 33–41. https://doi-org.proxy-ub.rug.nl/10.21500/20112084.2867

Kupers, E., & van Dijk, M. (2020). Creativity in interaction: The dynamics of teacher-student interactions during a musical composition task. *Thinking Skills and Creativity, 36*. https://doi-org.proxy-ub.rug.nl/10.1016/j.tsc.2020.100648

Kupers, E., Van Dijk, M., & Lehmann-Wermser, A. (2018). Creativity in the Here and Now: A Generic, Micro-Developmental Measure of Creativity. *Frontiers of Psychology, 9*(2095). doi: 10.3389/fpsyg.2018.02095

Kupers, E., Lehmann-Wermser, A., McPherson, G., & van Geert, P. (2019). Children's creativity: A theoretical framework and systematic review. *Review of Educational Research, 89*(1), 93–124. https://doi-org.proxy-ub.rug.nl/10.3102/0034654318815707

Lichtenberg, J., Woock, C., & Wright, M. (2008). *Ready to innovate: Are educators and executives aligned on the creative readiness of the U.S. workforce?* The Conference Board. https://www.americansforthearts.org/sites/default/files/ReadytoInnovateFull.pdf

Van de Pol, J., Volman, M., & Beishuizen, J. (2010). Scaffolding in Teacher-Student Interaction: A Decade of Research. *Educational Psychology Review, 22*(3), 271–296. https://doi-org.proxy-ub.rug.nl/10.1007/s10648-010-9127-6

Potasse, K. (2023). *STEAM (Further) AHEAD: Assessing Levels of Creative Expression in Special Primary Education Students* [unpublished master thesis]. University of Groningen.

Ramón, L. N., & Chacón-López, H. (2021). The impact of musical improvisation on children's creative thinking. *Thinking Skills and Creativity, 40*, 1–15. https://doi-org.proxy-ub.rug.nl/10.1016/j.tsc.2021.100839

Rhodes, M. (1961). An Analysis of Creativity. *The Phi Delta Kappan, 42*(7), 305–310. http://www.jstor.org/stable/20342603

Saggar, M., Xie, H., Beaty, R. E., Stankov, A. D., Schreier, M., & Reiss, A. L. (2019). Creativity slumps and bumps: Examining the neurobehavioral basis of creativity development during middle childhood. *NeuroImage, 196*, 94–101. https://doi-org.proxy-ub.rug.nl/10.1016/j.neuroimage.2019.03.080

Silverstone, J. (2018). Tuning In: Six Benefits of Music Education for Kids. *New England Journal of Higher Education.* https://doi-org.proxy-ub.rug.nl/https://www.nebhe.org/thejournal/tuning-in-six-benefits-of-music-education-for-kids/

Simonton, D. K. (2012). Taking the US Patent Office criteria seriously: A quantitative three-criterion creativity definition and its implications. *Creativity Research Journal*, *24*(2–3), 97–106. https://doi-org.proxy-ub.rug.nl/10.1080/10400419.2012.676974

Sungurtekin, S. (2021). Classroom and music teachers' perceptions about the development of imagination and creativity in primary music education, *Journal of Pedagogical Research, 5*(3), 164–186. https://doi.org/10.33902/JPR.2021371364

Todman, J.B., & Dugard, P. (2001). Single-case and small-n experimental designs. A practical guide to randomization tests. Hove, United Kingdom: Lawrence Erlbaum Associates, doi: 10.4324/9781410600943.

Webster, P. R. (1990). Creativity as creative thinking. *Music Educators Journal, 76* (9), 22-28. https://doi.org/10.2307/3401073

Webster, P. R. (2002). Creative thinking in music: Advancing a model. In T. Sullivan & L. Willingham (Eds.), *Creativity and music education* (pp. 16-34). Canadian Music Educators' Association.

Appendix A

Handleiding Coderen

Algemene introductie

Deze handleiding is geschreven voor het coderen van het niveau van divergent denken van een kind en het niveau van verbale autonomieondersteuning van een volwassene tijdens het uitvoeren van een één-op-één muzikale taak. Voor deze beide variabelen is een codeerprocedure en -schema opgenomen verderop in deze handleiding.

Het coderen wordt gedaan in Mediacoder (Bos & Steenbeek, 2017). Dit is een programma waarin videobestanden gecodeerd kunnen worden met een zelf ingevoerd codeersysteem.

Voordat begonnen wordt met het coderen van de data voor het onderzoek, is het van belang eerst goed in te trainen. Dit intrainen zorgt ervoor dat je als codeerder vertrouwd raakt met het codeersysteem, -programma en betrouwbaar codeert. Voor het intrainen kunnen video's gebruikt worden die niet in het uiteindelijke onderzoek als data worden gebruikt.

Beginnen met coderen

Voordat begonnen wordt met het coderen van het divergent denken en de verbale autonomieondersteuning, wordt dezelfde eerste stap uitgevoerd: de te coderen video wordt in zijn geheel bekeken. Dit is om een algemene indruk te krijgen van de video en de algemene indruk inclusief eventuele opvallendheden te noteren (een kind loopt weg, een stukje is onverstaanbaar, een kind is heel verlegen, et cetera). Tijdens het kijken worden ook de begin- en eindpunten van de codeerperiodes (zie hieronder) genoteerd.

Na het kijken van de video's kan worden begonnen met het coderen.

<u>Te coderen perioden</u>

In de video's doet elk kind twee verschillende taken: een taak met bekertjes en een taak met een kikker. Hieronder staan de codeermomenten van de video's die gecodeerd worden:

- Van beide opdrachten wordt de eerste 2,5 minuut na de uitleg gecodeerd. Dit noemen we de codeerperiode.
- Bij de bekertjes is het startmoment van de codeerperiode wanneer het kind/de volwassene één of beide bekertjes optilt om het eerste ritme te maken. Vanaf dat punt wordt de 2,5 minuut geteld.
    - De uitzondering hierbij is als het kind niet minimaal een minuut voor het einde van de codeerperiode de kans krijgt om zelf te beginnen met een ritme. De codeerperiode wordt dan zo verschoven dat het kind wel minimaal een minuut de tijd krijgt om zelf een ritme te beginnen. Een voorbeeld: het kind krijgt 20 seconden voor het einde van de codeerperiode de vraag van de onderzoeker of het kind een ritme wil verzinnen. Hiervoor is deze optie nog niet geboden aan het kind. De codeerperiode wordt dan 40 seconden verschoven, zodat het kind wel een minuut de tijd heeft om zelf ritmes te maken. Dit hoeft niet te betekenen dat het kind die hele minuut benut om ritmes te maken. Soms wordt er al snel weer gewisseld naar de onderzoeker die begint, omdat het kind niks meer kan verzinnen.
- Bij de kikkers is het startmoment wanneer het kind de kikker en het stokje pakt om de opdracht te beginnen.

In de codeerperiode wordt elke 10 seconden een score gegeven voor het hoogste niveau dat het kind/de onderzoeker heeft laten zien in de voorgaande 10 seconden. Elke video krijgt hierdoor per onderdeel (divergent denken en verbale autonomieondersteuning) 30 scores.

Algemene tips voor het coderen
Wanneer je twijfelt over een bepaald fragment, helpt het vaak om het fragment vertraagd af te spelen. Hierdoor zie je beter wat er gebeurt en zijn nuances tussen categorieën beter te zien. Mocht hierna nog steeds twijfel bestaan over welke score past bij een fragment, wordt de hoogste score gegeven. Dus als er twijfel is tussen score 2 of 3, scoren we een 3.

Coderen Divergent denken
Dit deel van de handleiding is gemaakt voor het coderen van het niveau van divergent denken dat een kind laat zien tijdens een één-op-één muzikale taak met een volwassene.

Nadat de video bekeken is, kan begonnen worden met het coderen van het divergente denken in de codeerperiode. Hiervoor moet eerst het codeerschema worden ingevoerd in Mediacoder (Bos en Steenbeek, 2017). Dit wordt gedaan volgens onderstaand Schema A1.

<u>On-task, off-task en pre-creative behavior</u>
Een leerling kan drie soorten gedrag laten zien: on-task behavior, off-task behavior en pre-creative behavior. On-task behavior houdt in dat een leerling zich bezighoudt met de taak en acties uitvoert die bij de taak horen. Hiervoor worden codes 1 t/m 4 gegeven.
Off-task behavior houdt in dat de leerling geen gedrag laat zien dat bij de taak hoort. Voorbeelden zijn: uit het raam kijken, luisteren naar uitleg, een verhaal vertellen. Deze gedragingen krijgen allemaal score 0.
De laatste categorie is pre-creative. Hieronder vallen alle dingen die een kind doet voordat het kind een actie kan uitvoeren. Voorbeelden hiervan zijn: nadenken, een vraag stellen over de opdracht, hardop denken. Deze gedragingen krijgen net als off-task behavior de score 0.

<u>De leerlinguitingen</u>
Elk kind laat verschillende acties zien. Deze acties noemen we leerlinguitingen. Elke leerlinguiting kan geplaatst worden in één van de categorieën in Schema A1. Voor het coderen van het divergent denken wordt gekeken naar de volgende definities van een leerlinguiting:

- <u>Bekertjes</u>: een volledig ritme dat een kind maakt.
- <u>Kikker</u>: elke wisselende actie van de leerling.
    - Een wisselende actie houdt in dat er duidelijk iets anders geprobeerd wordt (bijvoorbeeld op een andere plek slaan, de kikker optillen, wrijven in plaats van slaan).

Elke uiting wordt vergeleken met voorgaande uitingen in de codeerperiode. Dus als een uiting al eerder geprobeerd is, wordt 'imitatie' gescoord, is er een kleine aanpassing wordt een 'kleine variatie' gescoord, et cetera.

<u>Het coderen van het divergent denken in de leerlinguitingen</u>
Voor elke 10 seconden in de codeerperiode wordt een score gegeven aan de hand van onderstaand Schema A1 om het niveau van divergent denken aan te duiden. Hierbij wordt gekeken wat het hoogste niveau van divergent denken is dat een kind laat zien in de voorgaande 10 seconden. Als er meerdere leerlinguitingen zijn in de 10 seconden (bijvoorbeeld 2 keer een 1 en 1 keer een 3), wordt de 3 gecodeerd.

<u>Non-verbale en verbale uitingen</u>

Over het algemeen gaan verbale uitingen van het kind vaak samen met de non-verbale uitingen. Het schema is daarom gemaakt op non-verbale uitingen, omdat dat het beste past bij de aard van de creativiteitstaakjes. De non-verbale uitingen zijn dus leidend bij het coderen. De verbale uitingen worden wel meegenomen in het codeerproces. Als een verbale uiting wordt gegeven die hoger scoort in Schema A1 dan de hoogste non-verbale score in de 10 seconden, wordt de verbale uiting gecodeerd. Dit gebeurt bijvoorbeeld als een kind een nieuw idee noemt, maar dit niet direct probeert uit te voeren. Wanneer het kind dit idee later uitvoert, wordt dan 'imitatie' gescoord en niet 'nieuw idee', omdat het idee al eerder gecodeerd is.

Schema A1 – Coderen divergent denken

Dit codeerschema is gebaseerd op Hendriks et al. (2023), Kupers et al. (2018) en Potasse (2023)

Code	Label	Beschrijving	Voorbeeld
0	Non- or pre-creative	Voorbereidend gedrag voor het uitvoeren van een taak of gedrag niet gerelateerd aan de taak.	Uit het raam kijken, een verhaal vertellen, nadenken, een vraag stellen over de opdracht, een vraag beantwoorden van de volwassene, een instrument kiezen, luisteren naar de volwassene
1	Imitatie	Nadoen van de volwassene of het herhalen van een eerder eigen idee.	Bekertje: Hetzelfde ritme op dezelfde manier maken als hoe de volwassene of het kind dit eerder deed. Alle ritme-elementen zijn gelijk aan een eerder ritme Kikker: Slaan op de rug van de kikker nadat dit al eerder geprobeerd is of de volwassene het voordeed *Imitatie wordt ook gescoord als een kind een volwassene duidelijk probeert na te doen, maar dit niet helemaal goed doet.* *Imitatie is ook wanneer een kind een eerder verzonnen ritme uitlegt aan de volwassene en hierbij het ritme nadoet of probeert na te doen.*
2	Kleine variatie	Een subtiele aanpassing of een aanpassing van 1 element ten opzichte van eerdere uitingen van het kind en de volwassene	Bekertje: Eerder ritme: obr, lbr, ol Nieuw ritme: obr, obr, ol *Of* Eerst ritme zacht tikken en later hetzelfde ritme hard tikken *Ook het weglaten van 1 ritmeactie is een kleine variatie* Kikker: Zacht slaan en daarna hard slaan *Of*

			1 keer slaan en daarna dubbel slaan *Of* Slaan met de kikker op tafel en daarna slaan met de kikker in de hand
3	Grote variatie	Een aanpassing van meerdere elementen ten opzichte van eerdere uitingen van het kind en de volwassene. Het ritme is duidelijk gerelateerd aan een eerder ritme.	Bekertje: Eerder ritme: ol, bba, oba, oba Nieuw ritme: bl, bba, oba, bba *(aanpassing van meerdere ritmeacties)* *Of* Eerder ritme: ol, bba, oba, oba Nieuw ritme: ol, bba, oba, oba, bbl, bbr *(toevoeging van ritmeacties aan het eerdere ritme)* *Ook hier kan een wijziging van snelheid of volume zitten, zolang er ook een wijziging in een ander ritme-element zit.* Kikker: Zacht op de rug slaan en daarna hard op de onderkant slaan *Of* Langzaam wrijven en daarna snel wrijven en tikken tegelijk *Het samenvoegen van eerdere acties is ook een grote variatie. Dus als een kind al geslagen heeft op de kikker en de tafel en dat nu combineert, wordt een 3 gescoord*
4	Nieuw idee	De uiting bevat geen ideeën die al eerder zijn uitgevoerd.	Ritme: Het ritme bevat een combinatie van elementen die nog niet eerder is gebruikt en niet lijkt op een grote variatie. Eerder ritme: ol, oba, bl, bba (zacht) Nieuw ritme: bba, bbl, bbr, ol (zacht) Kikker: Eerst slaan op de kikker en daarna wrijven over de kikker

Uitleg ritmes

Een ritme bestaat uit verschillende elementen: ritme, tempo, volume en de ritmeacties. De ritmeacties zijn de specifieke acties die het geluid maken. Hier zijn verschillende veelvoorkomende soorten van die allemaal hun eigen afkorting hebben (zie uitleg hieronder). Als het gaat om een aanpassing van een element, wordt hiermee bedoelt dat er een wijziging zit in het ritme, tempo, volume en/of een aanpassing van 1 of meerdere ritmeacties.

Uitleg afkortingen ritmeacties
Obr: onderkant van de beker in de rechterhand op de tafel tikken
Obl: onderkant van de beker in de linkerhand op de tafel tikken
Oba: onderkant van allebei de bekertjes op de tafel tikken
Bbr: bovenkant van de beker in de rechterhand op de tafel tikken
Bbl: bovenkant van de beker in de linkerhand op de tafel tikken
Bba: bovenkant van allebei de bekertjes op de tafel tikken
Ol: onderkant van de bekertjes in de lucht tegen elkaar tikken
Bl: bovenkant van de bekertjes in de lucht tegen elkaar tikken

Coderen autonomieondersteuning
Dit deel van de handleiding is gemaakt voor het coderen van het niveau van autonomieondersteuning dat een volwassenen laat zien tijdens een één-op-één muzikale taak met een kind.

Het coderen van de autonomieondersteuning verloopt in dezelfde stappen als het coderen van het divergent denken alleen het schema dat gebruikt wordt voor het coderen verschilt. Nadat de video bekeken is, en de start- en eindpunten van de codeerperiode zijn genoteerd, kan begonnen worden met het coderen van de autonomieondersteuning in de codeerperiode. Hiervoor moet het codeerschema (Schema A2) worden ingevoerd in Mediacoder (Bos en Steenbeek, 2017).

On-task en 'anders' behavior
De volwassene kan twee soorten gedrag laten zien: on-task behavior en 'anders' gedrag. On-task behavior houdt in dat de volwassene praat en dus een verbale uiting laat zien in relatie tot de taak. Deze uiting krijgt een score van 1 t/m 4. Anders gedrag betekent dat de volwassene niet praat of een uiting geeft die niet gerelateerd is aan de taak. Anders gedrag krijgt meestal score 0 (voor uitzonderingen: zie hieronder 'het coderen van de volwassenuitingen').

Het coderen van de volwassenuitingen
De volwassene geeft meerdere verbale uitingen in de codeerperiode. Een uiting kan bestaan uit meerdere zinnen en is te plaatsen in één van de categorieën van Schema A2. Er begint een nieuwe uiting wanneer de onderzoeker duidelijk wisselt van onderwerp/soort uiting of als het langer dan 3 seconden stil is geweest. Voor elke 10 seconden wordt een score gegeven aan de hand van Schema A2 om het niveau van autonomieondersteuning aan te duiden. Hier geldt wederom dat als er meerdere uitingen zijn in het fragment, de hoogste uiting wordt gecodeerd.

Het is belangrijk om bij het bepalen van de score voor een uiting rekening te houden met de vorm, intonatie en inhoud van de uiting. Hierbij wordt gekeken in hoeverre er ruimte wordt gegeven door de volwassene voor eigen ideeën van de leerling. We kijken eerst naar de vorm van de uiting en daarna vergelijken we in hoeverre die overeenkomt met de inhoud en intonatie. Hierbij wordt ook gekeken naar de non-verbale uitingen die gepaard gaan met de verbale uitingen. Deze worden meegenomen om het totaalplaatje van de uiting te kunnen vormen en zo de meest passende score te geven. Als er een duidelijke non-verbale uiting is die niet samenhangt met een verbale uiting en hoger scoort dan de hoogste verbale uiting in de tijdsperiode, wordt de non-verbale uiting gecodeerd.

Schema A2 – Coderen verbale autonomieondersteuning

Dit schema is een aanpassing van het codeerschema van Hendriks et al. (2023).

Code	Label	Type uiting	Beschrijving	Voorbeeld
0	Off-task / Anders	Geen verbale uiting of een niet-taakgerelateerde verbale uiting	De volwassene praat niet of zegt iets wat niet gerelateerd is tot de taak	'Wat heb je een mooie jurk aan'
1	Low autonomy support	Instructie geven of aangeven dat leerling moet stoppen.	Autonomie beperken door leerlingen te laten stoppen of een instructie voor een handeling te geven waarin geen keuze is voor leerlingen. Instructie gaat meestal over handelingen die direct uitgevoerd moeten worden	Gebiedende wijs 'Doe mij maar na' 'Nog een keer' 'Zet de bekers neer'
2	Medium autonomy support	Informatie geven en leerkracht-gestuurde vragen	Informatie of uitleg geven om de leerling houvast en structuur te geven, evenals het stellen van vragen waarbij de volwassene een bepaald antwoord zoekt: weetvragen, aanvulvragen, aanwijzen. Hieronder valt ook feedback geven en steunteksten (zoals: 'onderkant, bovenkant, tafel' bij de bekertjes).	'Je kan ook de bovenkant van de bekers tegen elkaar aan tikken.' 'Je mag zo een ritme maken met de bekertjes' 'Kan je de buik van de kikker aanwijzen?' 'Klinkt het ene bekertje anders dan de andere?' 'Zullen we het nog een keer samen doen?' 'Wil jij het bekertje pakken?' 'Die was lastig hè?' 'Kun je dit ook?'
3	Medium-high autonomy support	(Denkstimulerende) leerlinggerichte vragen/ opmerkingen over algemene muzikale kennis	Vragen die keuze geven aan de leerling voor materialen of instrumenten en toestemming geven als leerlingen vragen of ze iets mogen. Ook vragen over algemene muzikale kennis	'Welk bekertje wil jij graag?' 'Zal ik beginnen of wil jij beginnen?' 'Wat is het verschil tussen zacht en hard slaan?' 'Ja, jij mag wel beginnen'
4	High autonomy support	Leerlinggerichte vervolgvragen, opmerkingen, cues en aanmoediging die creatief denken/handelen uitlokken	Creativiteit van leerlingen stimuleren. Leerlingen tijd geven om na te denken en vragen stellen die helpen bij het muzikale voorstellingsvermogen en het verzinnen/ uitvoeren van muzikale ideeën. Complimenteren en	'Hoe kan je het stokje nog meer gebruiken?' 'Goed zo, speel maar door' 'Mooi hoor dat ritme!' 'Ja' als bevestiging op een actie/opmerking van de leerling

			aanmoedigen om risico's te nemen. Hieronder valt ook exploratie- en denktijd geven aan de leerling	Exploratietijd geven: 'Je mag nu even de bekertjes proberen'

Appendix B

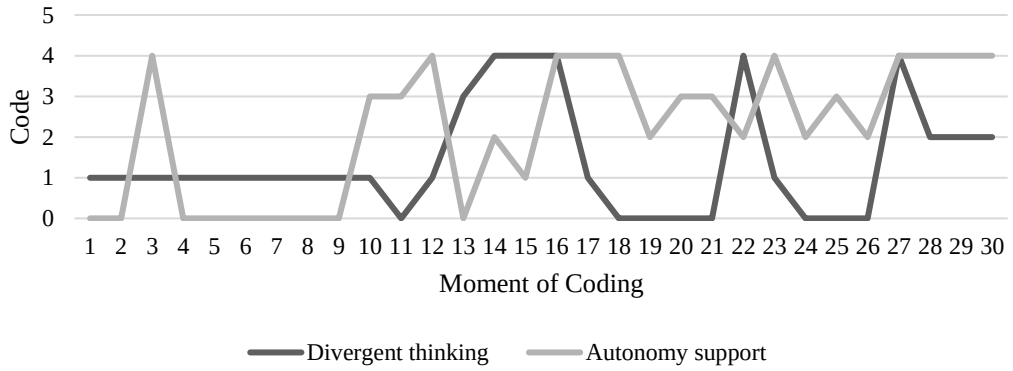
Figures

Figure B1

Individual Time series for Participants in Group 1

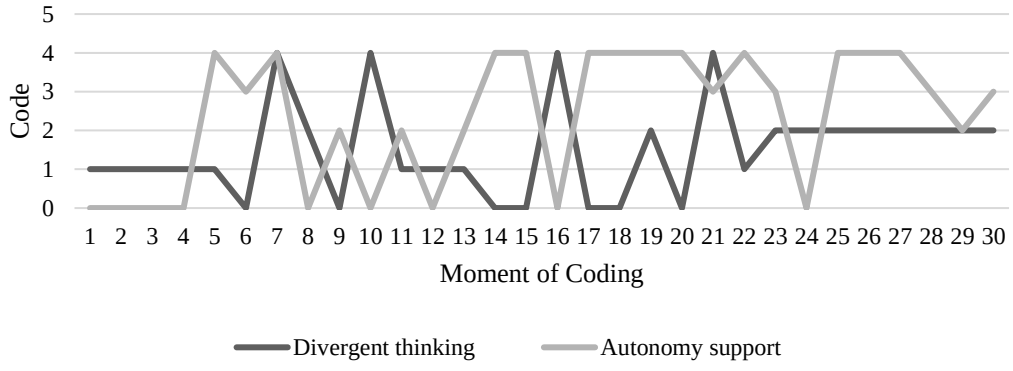
A

Participant A1



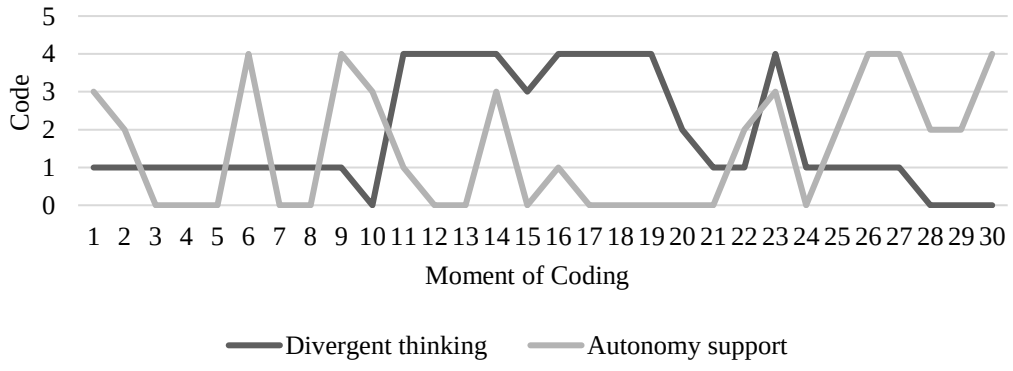
B

Participant B1



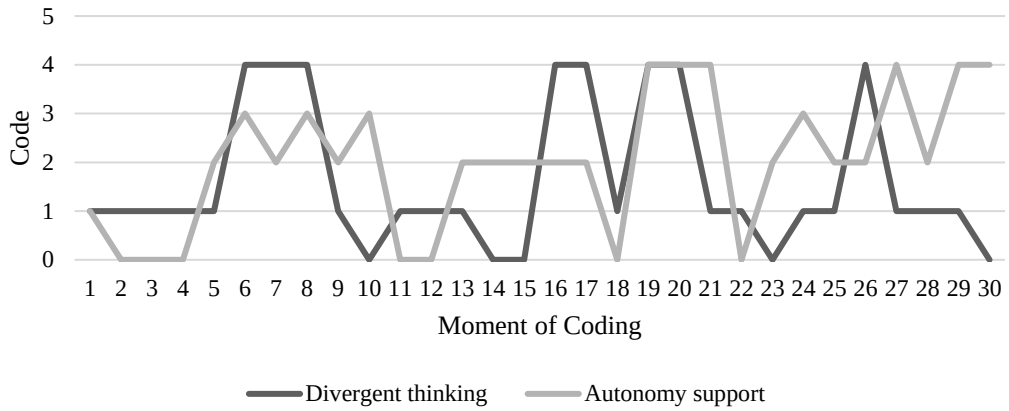
C

Participant C1



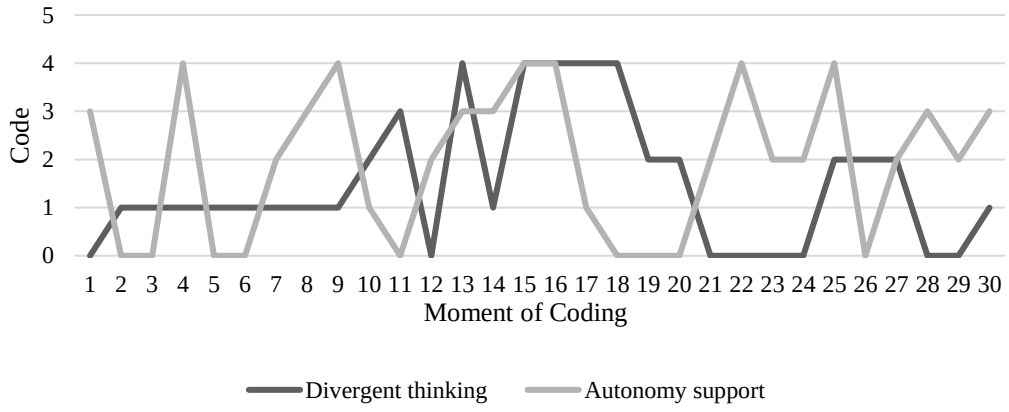
D

Partipant D1



E

Partipant E1



F

Partipant F1

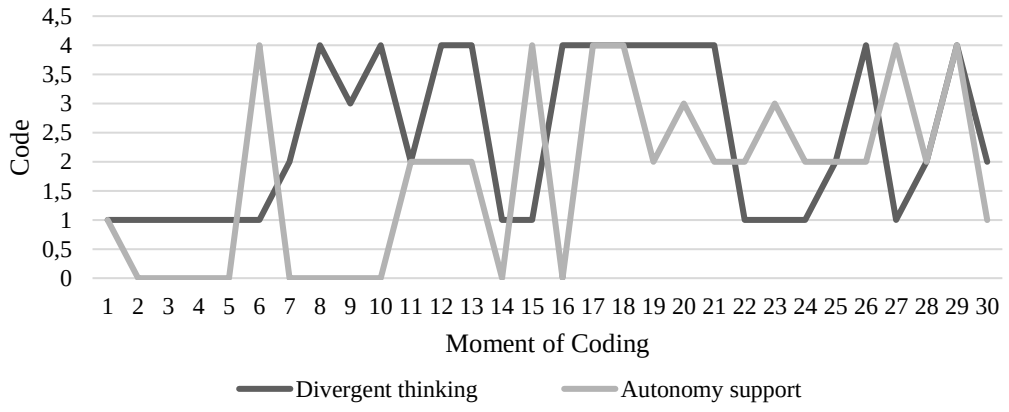
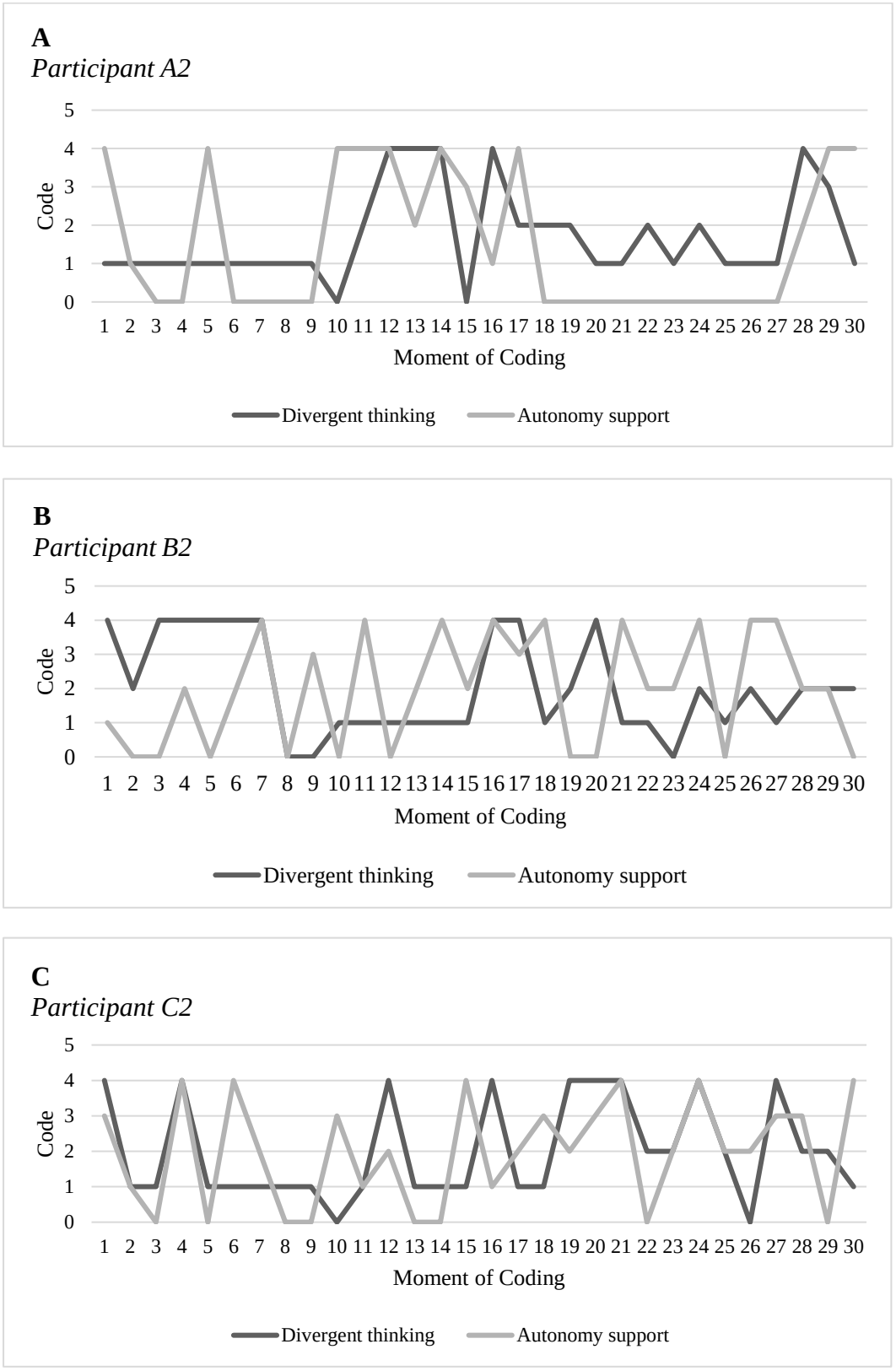


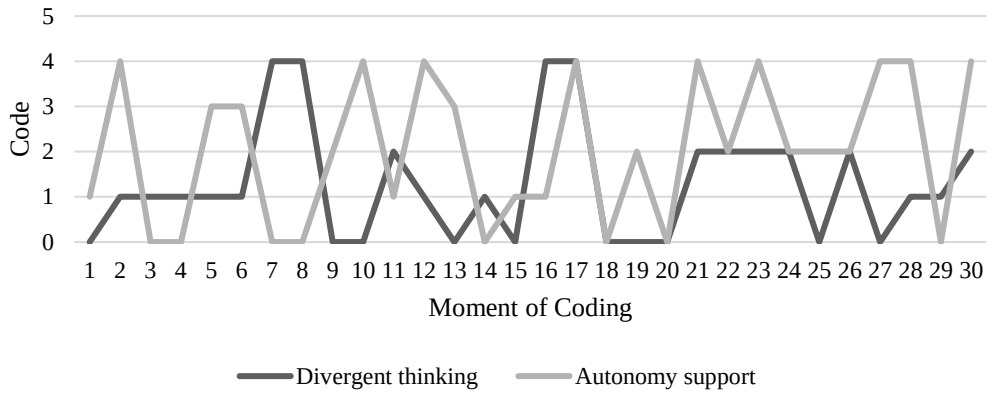
Figure B2

Individual Timeseries for Participants in Group 2



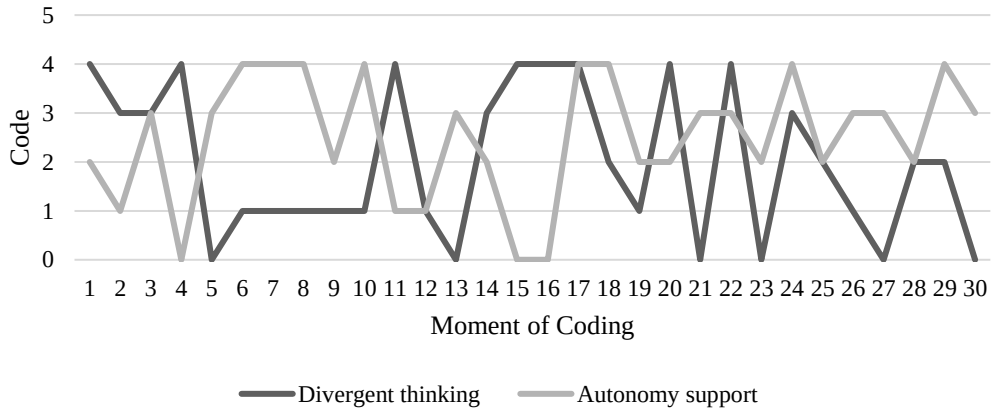
D

Participant D2



E

Participant E2



F

Participant F2