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Musical Flow Segmentation and Emotional Response of Music Students to Impressionistic Musical Piece

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Abstract

“Musical flow is the unit of a musical language, its highest-ranking unit, and it as a unity stays in the mind due to memory” (Popović, 1998: 152). The aims are: to establish the student’s ability to segment the piece at the syntax level; to learn about decision-making indicators in the segmentation; to determine the musical components that led the segmentation; to identify correlations of academic achievement and segmentation indicators; to find out about emotional response during listening the piece; to see the connection between the prevailing emotion when listening to decision-making indicators in the segmentation. A measuring instrument-questionnaire (6 general, 3 segmentation, 1 question for emotional response) and musical task (Debussy *Arabesque* 1) were heard twice with a score without markings for: meter, tempo, dynamic, bar-lines. After the first listening the respondents were asked to estimate the intensity of emotions and after the second listening they had to conduct segmentation. The results showed that they observed between 3–22 segments, while the average was 13 segments (expert assessment was 10). They segmented on the level of motive (26.4%), sentence level (70.1%) and macro level (3.4%). The average grade of students with theoretical directions was related to segmentation based on the knowledge of the piece, while the average grade of performers was related to segmentation based on the score. Students listen moderately segments without labels. The outgoing emotions are analogously with the character of *Arabesque*. The students with theoretical directions didn’t decide on segmentation based on the acquired knowledge that would apply in the new situation but based on the familiarity of the piece. Performers made segmentation based on the score-functioning of experience as a facilitation factor in perceiving chunks and segmentation. The practice of musical performance is more important than the learning of theoretical concepts—they don’t have application in new tasks.

Introduction

Background

The whole, in which the combination of the whole set of selected musical elements (elements of melody, rhythm, harmony, dynamics, agogic, texture, sound color, etc.) determines the choice of other musical elements, is called the musical flow. Within it, the musical sentence/phrase is the smallest standalone “higher order” whole. The meaningfulness of it represents the totality of all psychic factors that arise in our consciousness through sound relationships. The human mind remembers in the short term only the expressive motives and principles of their composition, while, in the longer term, it memorizes the entire sentence/phrase. A musical sentence/phrase is an indicator of emotional states (Popović, 1998: 152, 130, 236, 243, 235).

An important element for understanding the musical flow is the identification of a boundary that essentially articulates its being. The analysis involves the separation of different procedures in the process of drawing boundaries and determining their role in the realization of the musical flow. The importance of the border is because it separates, but also connects segments in the musical flow (Sabo, 2012: 22, 33).

The core of any music activity is cognition and then emotion. Cognition makes it possible, gives structure and pattern, and enables the conceptualization of music. Cognition in listening implies a structural term that refers to the segmentation of a structure and units are perceived as sequential or as stratified. The segmentation accomplished on three levels implies: micro syntactic, mezzo and macro level (Popović Mladenović, Bogunović, & Perković, 2014: 205, 192, 208).

Most people point to emotions as their main motivation for listening to music (Komosinski & Mensfelt, 2016: 432). The emotion evoked in the listener was the same as the emotion expressed in music, which is consistent with the idea that music can evoke emotions through the process of emotional contagion (Popović Mladenović et al., 2014: 34). The fusion of emotion and thought in music forms an aesthetic response to music (Popović Mladenović et al., 2014: 207).

In this paper, we were interested in the research of the musical flow segmentation, in the musical piece from the era of impressionism and its relatedness to cognition and emotions, as well as with the subjective perception of the duration of the musical piece.

Aims

1. To establish the students' ability to segment the musical piece from the era of impressionism at the level of the musical sentence/phrase (not at the level of motive!)
 - To learn about decision-making indicators in the segmentation process;
 - To determine the musical components that led the segmentation;
2. To identify correlations of academic achievement and segmentation indicators;
3. To find out about emotional response during listening the impressionistic musical piece;
 - To see if there is a relationship between the emotion that prevails when listening and the indicators of decision making in the segmentation process.

Research Method

Sample

The sample consists of students from different departments of bachelor, master and doctoral academic studies at the Faculty of Music in Belgrade. The research involved 87 respondents, 52.8% from the theoretic departments (music pedagogy, music theory, musicology, ethnomusicology and composition) and 47.2% from instrumental departments (strings, e wind instruments, poly-instrumental – guitar and

harpsichord, piano, jazz, solo singing), whose number is roughly even. Of the 87 respondents, 28.7% were male and 71.3% were female.

Variables

In this research, four groups of variables are present. The first group consists of general variables and they relate to gender, age, year of study and department attended by respondents. The second group are indicators of decision making about segmentation (acquired knowledge of musical form, intuition, score, articulation or knowledge of the piece based on playing or listening) and assessing the intensity of emotions (Likert scale from 1 to 5). The third group is about estimating the length of the piece. The fourth group refers to the level of segmentation (sentence level, macro level and motive level) and to the musical components of segmentation (caesura, beginning signal, end signal, melodic decline, longer note value, agogic and articulation, according to Sabo, 2012: 32) received from the marks in the score of the respondents.

Measuring Instrument

The measurement instrument contains two parts – the first part is a combination of questions and music task and the second part contains questions. After answering general questions, the respondents heard for the first time a musical piece – Debussy's *Arabesque* No. 1 (5.07 minutes, Harris, 2017), in order to have an insight into the overall composition and thus being able to look at the score from which, the labels for time signature, tempo, bar-lines, and dynamics, were removed.

The main part followed when the respondents listened to a piece of music once more and conducted a segmentation of the musical flow at the structural (middle) level, at the phrase/sentence level (not at the level of motive!). After the second listening, they were supposed to write down the number of segments they felt to exist in the musical piece. They then estimated the presence of decision making indicators for segmentation and accordingly had to answer the question about their success in segmenta-

tion of the piece. This question, as before, was conceptualized by using a Likert-type scale (from 1 to 5).

In addition, they needed to evaluate the intensity of the emotion after listening to the entire musical piece. They then evaluated the timing of the composition, writing for themselves as long as they thought the musical piece selected as the sample lasted.

Sound Material

A sound task, *Arabesque* No. 1 by Claude Debussy (*Achille-Claude Debussy*), performed by Noriko Ogawa (*Noriko Ogawa*), was used (Harris, 2017). The score was made in the computer program *Sibelius* 6.0.0 (Finn & Finn, 1987–2009) to remove bar-lines, as well as time signature, tempo, and dynamics, while a sound recording was played from the computer.

Data Processing

Data processing was performed in the computer program *SPSS Statistics*. The obtained results were created by descriptive analysis, correlation analysis (Pearson correlation coefficient), Crosstabs analysis and factor analysis (Principal component analysis).

Results

Description of the Elements of Segmentation, Achievement and Emotional Response

The indicators of segmentation. In one part of the questionnaire, the respondents have declared themselves about the indicators that they have activated during segmentation. From Table 1 below, it can be seen that most of them segmented the musical flow of the impressionistic piece intuitively ($M = 4.10$, $SD = 1.14$), based on the score ($M = 3.52$, $SD = 1.34$) and on the basis of their acquired knowledge of musical form ($M = 3.40$, $SD = 1.19$), as expected, because these three things are pervading. Intuitiveness is related to the acquired knowledge of musical form to all respondents, while mastering the score is related to the previously acquired knowledge. However, the results show that the smallest number of respondents segmented on the basis

of experience in playing this piece ($M = 1.15$, $SD = .66$), which means that very few of them were familiar with the chosen music sample in practice.

Table 1. The indicators of the decision on segmentation.

Segmentation indicators	M	SD	N
The knowledge of musical form	3.40	1.19	86
Intuition	4.10	1.14	87
Knowing the pieces based on listening	3.32	1.56	85
Experience in playing the piece	1.15	.66	85
The score	3.52	1.34	85
Articulation (ligature, agogic)	3.19	1.33	84

The Duration of the Piece

Music students were asked to estimate the duration of the selected piece of music, which is 5:07 minutes, and the result shows that the majority of respondents (34.5%) estimated that the composition lasts 5 minutes. This result shows that students have been very successful in estimating the duration of a musical piece because their assessment is close to its real duration.

The Segmentation of a Musical Piece

Based on the task given to the respondents to conduct the segmentation and to declare about the number of segments obtained after it, the results show that they perceived between 3 and 22 segments, while the expert evaluation was 10, with the highest number of respondents (18.4%) answered that there are 13 segments in the composition. Accordingly, the data indicate that music students on the basis of hearing moderately well hear segments of a musical piece when there are no labels.

Segmentation Levels

Music students segmented the musical flow mostly at the sentence level (70.1%), which was expected, according to the instructions they received before and during the research. The instruction was that, after the second listening,

they should segment the musical flow on a mid-level – at the phrase/sentence level (not at the motive level!) by drawing vertical lines in the score. Some students also segmented at the level of motive (26.4%), as well as at the macro level – at the level of periods and sections (3.4%), however, they are less present because the reading of the results shows that segmentation at the syntactic level prevails.

Musical Components

Based on different musical components, music students conducted a segmentation of the musical flow. Based on a qualitative analysis of student’s verbal responses, the categorization of responses was made. It can be seen from the Table 2 that the largest number of respondents conducted segmentation on the basis of articulation (32.2%) and on the signal of the end (23.0%), indicating that they included previously acquired knowledge of musical form as well as agogic (21.8%), while the smallest number of respondents segmented the musical flow based on caesura (1.1%).

Table 2. Musical components as guidance in conducting segmentation.

Segmentation in the score	Percent (N = 87)
Caesura	1.1%
Signal of the beginning	9.2%
Signal of the end	23.0%
Melodic decline	10.3%
Longer note	2.3%
Agogic	21.8%
Articulation	32.2%

Average Grade and Self-assessment of Students

Looking at the results we can see that the average grade of students with theoretical directions (Analysis of Musical Forms) is $M = 8.78$, $SD = 0.91$ while the average grade of performers (Analysis of Musical Work) is $M = 8.75$, $SD = 1.10$, which shows the same average grade for students with theoretical directions and performers (Table 3).

Regarding the self-assessment of music students in the segmentation of musical flow, the

result is $M = 3.32$, $SD = .82$. As this question is conceptualized by using a Likert-type scale, it can be observed that their self-assessment is positioned in the middle of the scale, which means that they are good at the segmentation of the musical flow.

Table 3. Average grades of students from the subject Analysis of musical forms (theoretical departments) and Analysis of the musical piece (instrumental departments) and students’ self-assessment of success in segmentation.

The achievements of students	M	SD	Min	Max	N
Average grade AMF	8.78	0.91	6	10	43
Average grade AMW	8.75	1.10	6	10	40
Self-assessment of performance in segmentation	3.32	0.82	1	5	85

Perceived Emotions

Respondents evaluated the intensity of 12 emotions after listening to the whole piece of music (Likert scale from 1 to 5). The results in Table 4 show that students find that the musical piece most evokes the emotion of relaxation ($M = 4.31$, $SD = .91$), satisfaction ($M = 4.23$, $SD = .83$) and carelessness ($M = 4.08$, $SD = 1.10$),

Table 4. Reported intensity of each emotion students experienced in listening.

Emotions	M	SD	N
Happiness	3.54	1.02	63
Joy	3.58	.98	81
Excitement	3.16	1.25	81
Carelessness	4.08	1.10	83
Pleasure	4.23	.83	82
Relaxation	4.31	.91	85
Depression	1.33	.72	80
Sadness	1.75	.88	83
Monotony	1.59	.97	81
Suffering	1.60	.84	81
Anger	1.11	.39	80
Fear	1.20	.55	81

which is consistent with the character of *Ara-besque*. On the other hand, all emotions in the opposite spectrum are consistently low, with sadness, monotony and suffering somewhat more pronounced, and in keeping with the melancholy nature of the piece.

In order to get a clearer picture of the reaction to the musical piece, a factor analysis (Principal component analysis) with Varimax rotation and Kaiser normalization was also performed, using a two-factor solution. The content of the two factors is different, but the domains of the respondent's emotional responses to listening to the piece are clearly distinguished (Table 5). The first factor is saturated with emotions of happiness, joy, and excitement, while factor two is overwhelmingly saturated with feelings of depression and sadness, but also of anger and fear. The second factor has a lower degree of saturation, but there is clearly an emotional reaction in the “negative” spectrum of emotions.

Table 5. Additional assessment of the reaction to the musical piece.

	Rotated Component Matrix ^a	
	Component	
	Factor 1	Factor 2
Happiness	.834	
Joy	.791	
Excitement	.697	
Carelessness		-.696
Pleasure		
Relaxation		
Depression		.715
Sadness		.503
Monotony		.557
Suffering		
Anger		.562
Fear		.609
Variance	29.568%	14.635%

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

The Relationship Between Segmentation with Achievements and Emotional Response

1. The segmentation of the musical piece.

Reading the results, one could see that music students segmented the musical flow most often at the sentence level (70.1%), which was expected according to the instructions they received before and during the research. However, there are students who have segmented both, at the level of motive (26.4%) and at the macro level – at the level of periods and sections (3.4%), however, they are less present because it is obvious from the results that segmentation on a syntactic level is predominant.

By calculating the correlation between indicators for making decisions in segmentation, a statistically significant correlation was found between segmentation of the musical flow based on score and segmentation of the musical flow based on acquired knowledge of musical form ($r = .22, p = .041$). This allows the conclusion that the acquired knowledge is activated in the segmentation of the musical flow and, accordingly, it is logical that music students are able to follow the score. The results also show that there is an association between segmentation based on the score and segmentation of the musical flow based on articulation – ligature, agogic ($r = .49, p < .001$). Just as students are able to follow the score because of their acquired knowledge, they are also able to read graphic symbols from the score. Accordingly, this correlation is expected. Interestingly, intuitive decision making about segmentation was negatively correlated with acquired knowledge ($r = -.28, p = .009$) and knowledge of the piece based on listening ($r = -.25, p = .019$). This finding confirms the presence of two completely opposite strategies in making decisions.

In order to segment the musical flow at any level, it is necessary to include musical components for its implementation. In the section of description variables, we presented the musical components that students relied on when they were conducting the segmentation.

However, by monitoring the correlation between the number of segments in segmentation with the indicators of decision making in seg-

mentation, it appears that there are no statistically significant correlations. On the other hand, it has been shown that with the increase in the number of observed segments the level of segmentation decreases ($r = .65, p < .001$), which means that the more general level of perception of a musical piece also leads to the observation of a smaller number of segments. This finding is not expected because some of the indicators need to be activated in order to conduct successful segmentation of the musical flow, which indicates to questions related to the methodology and practice of music analysis and formal analysis as disciplines taught within higher music education.

An interesting finding indicates that there are significant differences in using musical components in the segmentation when it comes to segmentation levels ($\chi^2(86) = 29.71, p < .001$). In Figure 1, we observe that students performed segmentation at the level of motive by activating the signal of beginning (3.4%) and caesura (3.4%), to a minimum they perceived agogic (1.1%), while they mostly implemented segmentation at this level by activating articulation (18.4%). On the other hand, segmentation at the sentence level was performed by activating the signal of beginning (5.7%), caesura (10.3%) and articulation (11.5%) to a lesser extent, agogic (20.7%) to a greater extent, and it is observed that the component is the signal of end (21.8%) largely influenced to the segmentation at this level. However, it is observed that segmentation of the musical flow at the period/section level comprises two components that have most in-

fluenced the segmentation at the motive and sentence levels, namely the end signal and the articulation. The end signal (1.1%) had less influence on segmentation at the period/section level, while articulation (2.3%) had a greater share in this.

Nevertheless, the activity of agogic and end signal are most pronounced at the sentence level. Articulation, which is dominant in segmentation at the level of motive, is similarly represented. On the other hand, a significant difference is observed in the use of articulation in the segmentation at the period/section level. Its activity is extremely low compared to articulation activity at the level of motive and compared to end signal and articulation at the sentence level. Although a partial coincidence in the selection of components at different levels is observed, their activity varies. At the motive level, as well as at the sentence level, the activity of certain components is very high (articulation, agogic, end signal), while at the period/section level it is very low (articulation, end signal).

2. Correlation of academic achievement and segmentation indicators. Considering the correlations between the average grades in the Analysis of Musical Forms (AMF) and in the Analysis of Musical Work (AMW) with indicators for making decisions in the segmentation, it is observed that the average grade of students with theoretical directions is correlated with segmentation based on their knowledge of the musical piece through listening ($r = .33, p = .002$), while the average grade of performers is correlated with segmentation based on the score ($r = .38, p < .001$). This result leads to the conclusion that the students with theoretical directions were familiar with the musical piece even before the research, while the performers segmented the musical flow based on the score and were not familiar with the musical piece before the research.

Interestingly, students with theoretical directions did not make a decision about segmentation based on the acquired knowledge they would apply in the new situation, but rather on knowing the pieces through listening. In con-

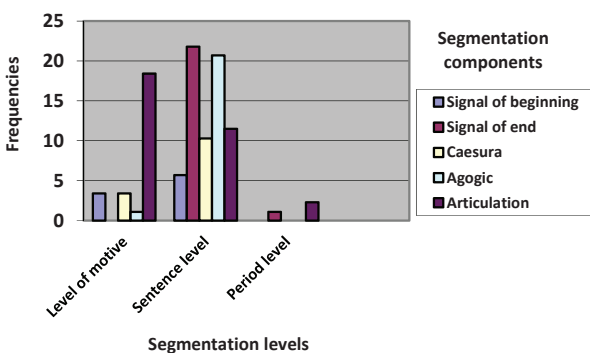


Figure 1. The relationship between levels and musical components in segmentation (crosstabs).

trast, performers were more likely to make decisions about segmentation based on the score, which indicates the action of experience as a facilitation factor in spotting “chunks” and in the segmentation (Leman, Sloboda, & Woody, 2012: 133). These facts suggest that the practice of musical performance is a more significant factor than learning theoretical concepts since they have no application in new tasks. Consequently, education does not have the result that would be expected. It is this result that points us to certain limitations that the curriculum of academic music education has.

The second result shows a correlation between the self-assessment of segmentation performance and the segmentation indicator based on the acquired knowledge of musical form ($r = .31, p < .01$). This correlation shows the expected awareness of music students about personal knowledge in the segmentation of musical flow.

In addition to this result, a correlation between self-assessment of segmentation performance and the segmentation indicators based on the articulation is shown ($r = .34, p = .003$). The link between them suggests that higher self-efficacy has its foothold in the strategy of using articulation cues as a basis for decisions in the segmentation.

3. The emotional experience of the students in the segmentation of a musical piece.

The intensity of 12 emotions in response to listening to a piece (happiness, joy, arousal, carelessness, pleasure, relaxation, depression, sadness, monotony, suffering, anger, fear (Hunter & Schellenberg, 2010: 135) is related to the parameters of segmentation. The results indicate a significant association between the emotion of happiness and segmentation based on acquired knowledge of musical form ($r = .29, p = .006$). The fact that emotions are already built in the experience of instrumental performance is shown by the existence of association between arousal and the segmentation of musical flow ($r = .25, p = .019$). Consistent with these results, an association was observed between the emotion of pleasure and the segmentation of the musical flow based on familiarity with the musical piece through listening ($r = .31, p = .003$). Knowing the piece causes the pleasure of listening again.

The results regarding the association between student’s emotional response and the number of segments are not statistically significant. Also, no significant correlation was shown between any emotional response to a piece of music and some of its musical components. It can also be understood that segmentation is primarily a cognitive activity, which involves analytical processes and incorporates knowledge and knowledge of existing models by which segmentation is performed. Also, the results do not indicate a statistically significant correlation between the emotional experience of music students and their assessment of the duration of a musical piece. This indicates the absence of an emotional aspect in assessing the duration of a piece, that is, indicating the predominance of cognitive processes in that task.

Conclusions

The research was conducted to establish the degree of mastery of analysis/segmentation of a piece of music by music students while listening to Claude Debussy’s impressionistic piece *Arabesque No. 1* (Harris, 2017). The place of cognitive processes and operations, as well as the emotions experienced during segmentation of the musical flow, were examined. In addition, some measures of academic musical achievement and their correlation with indicators and segmentation components were examined. The results indicate that students from the Faculty of Music successfully completed the task of estimating the duration of a piece because their assessment is closer to its real duration. Their success is reflected in the results which show that they segmented the musical flow most at the sentence level, to a lesser extent at the motive level, as well as at the macro level – at the periods and sections level. However, they are less present, as the results indicate that it is obvious that segmentation at the syntactic level is prevalent. By looking at the different musical components that students used to perform the segmentation of the musical flow, it could be seen that the majority of respondents conducted segmentation based on articulation and on the end signal, indicating that they included prior

knowledge, as well as agogic. The smallest number segmented the musical flow based on caesura. This result is important because, without musical components as guidance, segmentation at any level would not be possible. By calculating the correlation between the segmentation levels and components in the segmentation, a result is obtained showing that music students, when segmenting the musical flow at different levels, include the musical components as guidance, which is expected because these two variables are interrelated in practice. This is supported by the correlation between the components on the basis of which the respondents segmented and the number of segments they received after segmentation.

The results obtained by looking at the indicators for making decision about segmentation show that the most students segmented intuitively, and to a lesser extent on the basis of the score and the acquired knowledge of musical form, which was contrary to the initial expectations since the assumption was that the acquired knowledge of musical form would be applied in segmentation. However, the results show that the smallest number of respondents segmented on the basis of playing the pieces, which means that very few of them were familiar with the chosen musical example in practice.

On the other hand, by noting the correlations between the indicators themselves, a correlation could be observed between segmentation based on the score and segmentation based on the acquired knowledge of musical form, since the assumption that the acquired knowledge is activated during the segmentation is confirmed, that is, music students are trained to follow the score. Based on their acquired knowledge, they are also able to read graphic symbols from the score because of the connection between segmentation based on acquired knowledge of musical form and segmentation based on articulation. However, the correlation between the number of segments in segmentation with the indicators for making a decision in the segmentation does not prove statistically significant, which is not expected because some of the indicators need to be activated in order to carry out segmentation of the musical flow.

Considering the average grades of students with theoretical directions (Analysis of Musical Forms) and performers (Analysis of Musical Work) is the same. Correlation between average grades in Analysis of Musical Forms (AMF) and Analysis of Musical Work (AMW) with indicators for making decision in the segmentation indicates that the average grade of students with theoretical directions is related to the segmentation based on their knowledge of the musical piece through listening, while the average grade of performers correlates with the segmentation based on the score. Accordingly, it concludes that students with theoretical directions were familiar with the musical piece even before the research, while the segmentation from the performers were based on the knowledge of score and were not familiar with it before the research. These facts suggest that the practice of musical performance is a more significant factor than learning theoretical concepts since they have no application in new tasks, that is, education does not have the expected result.

The correlation established between self-assessment of segmentation and segmentation based on the acquired knowledge of musical form shows the expected awareness of music students about personal knowledge in conducting segmentation. In addition, there is a correlation between self-assessment in segmentation and articulation-based segmentation, suggesting that articulation-based segmentation is also good analogous to self-assessment in segmentation and vice versa. Accordingly, the respondents, in their self-assessment, carried out the segmentation mostly with the help of articulation.

Considering the emotional response of the students, it has been shown that the carelessness, pleasure, and relaxation of the emotions they chose when listening to the musical piece are in accordance with the character of the piece. On the other hand, all emotions in the opposite spectrum are consistently low, with sadness, monotony and suffering somewhat more pronounced, and in keeping with the melancholy nature of the piece. By conducting factor analysis, a clearer picture of the response to the musical piece was obtained. The first factor

is saturated with emotions of happiness, joy and excitement, while on the contrary, factor two is overwhelmingly saturated with feelings of depression and sadness, but also of anger and fear. Although it is noted that the second factor has a lower degree of saturation, there is clearly present an emotional reaction in the “negative” spectrum of emotions.

Nevertheless, the results indicate that there is no correlation between emotional response and segmentation of the musical flow and that no connection is made between the emotional experience of music students and their assessment of the duration of a musical piece. However, by looking at the correlations between student’s emotional responses during segmentation, it is concluded that music students are happy while using prior knowledge in the segmentation, they show excitement because they recognize the musical piece they played and are happy as soon as they recognize it during listening. However, they do not use emotions while they segment the musical flow, which is not expected and is not consistent with the previously interpreted results, as the emotional aspect in students is lacking in their assessment of the duration of the piece.

It can be concluded that the students were successful in estimating the duration of the piece, as they also successfully conducted segmentation at the sentence level by incorporating musical components. The practice of musical performance is a more significant factor than learning theoretical concepts, which is why performers were better off compared to students with theoretical directions. Their self-assessment of their success in the segmentation of the musical flow showed that they were good at its realization, while the emotional response of the students was also consistent with the character of the piece, which is why they proved successful in this aspect as well. The results obtained are important for understanding the issues of this research and raise many questions that could serve as a basis for new empirical researches.

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