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REVISTA ELECTRÓNICA DE LEEME
(LISTA EUROPEA ELECTRÓNICA DE MÚSICA EN LA EDUCACIÓN)
NUMBER 31 (JUNE, 2013), PP.107-116
HTTP://MUSICA.REDIRIS.ES/LEEME

The Assesment of Emotions in Music Rhythm Training with Computers at Three Chilean Music Education Institutions

Evaluación de emociones durante el adiestramiento rítmico con ordenadores en tres instituciones chilenas de educación musical

Rafael García Pérez[2]
rafaelgarcia@us.es

Jesús Tejada[1]
jesus.tejada@uv.es

Manuel Jesús Espigares[2]
manuelespigares@yahoo.es

María Ángeles Rebollo[2]
rebollo@us.es

[1]Dto. de Didáctica de la Expresión Musical, Plástica y Corporal
University of Valence, Spain
[2]Dto. de Métodos de Investigación y Diagnóstico en Educación
University of Seville, Spain

Recibido: 14-1-13 Aceptado: 25-05-13

Abstract

The primary aim of this work is to investigate the "emotional dimension" as a criterion for evaluating an educational music software called Tactus. In order to collect data, two training sessions were carried out with volunteer students (N=45) in specialized music education at three Chilean institutions. After, an evaluation was carried out using an assessment instrument, which was devised to determine the emotions, both positive and negative, which come into play when a student uses Tactus, and thereby measure the emotional dimension to determine the quality of the program in the affective domain. This instrument, a checklist of positive and negative emotions, was completed as part of a student/user report, included in a more global evaluation questionnaire completed at the end of the two weeklong training sessions with Tactus. The positive results confirm previous, other traditional assessments that describe Tactus as a useful support tool for teaching rhythm in educational environments. The results of this study also suggest that that evaluation of the emotional dimension may be useful in the general scope of the evaluation of educational software.

Keywords: Emotions, Assessment, Rhythm Training, Music Technology,

Resumen

El objetivo de este trabajo ha sido investigar la dimensión emocional como criterio de evaluación de un programa de ordenador para el adiestramiento del ritmo musical (Tactus). Se desarrolló un trabajo empírico que consistió en dos sesiones de adiestramiento rítmico con el programa Tactus por alumnado voluntario (N=45) que cursaban estudios en instituciones chilenas de educación musical especializada. Posteriormente, se realizó una evaluación utilizando un instrumento diseñado para determinar las emociones positivas y negativas percibidas por los sujetos cuando usaron Tactus, por tanto una medida de la dimensión emocional que determina la calidad del programa en el dominio afectivo. Este instrumento, una lista de comprobación de emociones negativas y positivas fue completado como parte de una evaluación global realizada al final de las dos sesiones de adiestramiento con el programa. Los resultados positivos confirman otras evaluaciones de Tactus que lo describen como una herramienta útil para la enseñanza del ritmo musical en contextos educativos. Los resultados de este estudio también sugieren que la evaluación de la dimensión emocional puede ser útil en el dominio general de la evaluación de software educativo.

Palabras clave: emociones, evaluación, adiestramiento rítmico, tecnología musical.

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LEEME

LISTA ELECTRÓNICA EUROPEA
DE MÚSICA EN LA EDUCACIÓN

1. Introduction

As emotions play an important role in the learning process, it therefore follows that the design of any didactic media to support learning should take the learner's emotions into account. However, very little was known about role and phenomenology of emotions in learning processes developed in different learning environments, most notably in learning supported by current technologies and multimedia tools used in our society (Pekrun, 2005). Gender studies have demonstrated that little consideration has been given to people's emotional dimension not only in social issues but also in institutions and educational processes, as its deficit was linked to some extent with failure and loss of interest in education (Rebollo et al., 2006). Some researchers uphold the role of emotions in educational processes supported by ICT, noting that certain proposals investigate and evaluate resources, strategies and activities aimed at the emotional regulation of educational processes and its analysis in online educational communication (Aires et al., 2006; Bostock and Lizhi, 2005). These studies affirm the importance of incorporating the analysis of the emotional dimension and the affective domain in the production of multimedia as educational material. In the case of our current work, this refers to the consideration and evaluation of emotional responses arising in students of elementary music during the use of the rhythm training program Tactus.

Although there has been great debate on the differences between emotion and cognition, the debate is irrelevant when considering emotions in the process of learning, as little importance is placed on these differences by people working in this field or on the differences which could be seen between concepts such as emotions, feelings, passions, or affective states (Guedes and Alvaro, 2010). Furthermore, neuroscience also refers to the link between emotion and cognition, especially in socio-constructionist and socio-cultural approaches, where emotion is conceived as a social construction: emotions are formed strategically in social interaction in meaningful contexts. Emotion is seen as an emerging phenomenon, formed by processes that seek to activate the most congruent response to any situation -or deactivate incongruent responses- (Barret, Oschner and Gross, 2007).

As emotions clearly affect cultural activities either beneficially or adversely, the important factor for this study is not the strict classification of an object as an emotion, a feeling or an affective state, but whether the "emotion" stimulates or hampers the performance of tasks in learning situations. The idea of using the emotional dimension as a criterion of quality of this software arose from the fact that in the educational and social world, little evidence is needed to demonstrate the presence of emotions in the learning process, as all people experience emotions when participating in education. Before proceeding, however, the types of "emotion" that are applied in the evaluation of educational software must be described at the scientific level. Based on dialogic vision and the socio-genetic base of emotions, not only primary, basic and

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globally shared emotions (joy, sadness, fear, etc.) were considered, but also secondary, culturally learned emotions which are experienced on certain occasions as a process of emotional scaffolding involved in human educational activity (appreciation, pride, guilt or shame). This line of work on emotions was developed on a psychological basis using the Socio-Cultural Approach initiated by Vygotsky as a reference, and later updated by authors such as Cole (1999), Wertsch (1993), etc. Various contributions from this perspective have also dealt with the study of secondary human emotions (Govert and Gavelek, 1997; Rebollo, 2006).

Three basic ideas are common to each of the above studies: 1) Emotions are constructed socially in a relational process. (2) Emotions are mediated by psychological and material resources from the social contexts in which people develop and define their identities. (3) Emotions are indicators of the relationships people establish with educational contexts and values, and therefore indicate a moral horizon that leads to certain behaviour in a given situation (appreciation and acceptance, rejection and abandonment, etc.). Hence the importance of emotions is evident in educational activities, as emotions can support development and persistence or in contrast, lead to discouragement.

It is generally understood that in the educative process, students who learn to understand and regulate their own positive and negative emotions have greater potential to adapt and develop their educational objectives toward a culture of reaching the maximum capability possible with support. It therefore follows that the practice of students analyzing and understanding their own emotions can become a means of recognizing the quality of didactic media in terms of both learning and also the support provided to the student by the medium in each learning activity. This refers to the recognition of the emotions raised through activities with each didactic medium and to the understanding of how effectively students use the *emotional scaffolding* proposed by each didactic material. This leads to the idea of using an assessment tool based on a "balance of emotions" to assess the quality of a didactic medium. Software support that raises largely positive emotions can be seen as useful didactic media. In contrast, software support that raises only or largely negative emotions can lead to students abandoning the task that the media is supposed to be supporting. These types of programs, in which the negative emotions are not offset by more positive emotions, are doomed to failure and rejection for use in music schools. Therefore, as regards educational software, the results of a "balance of emotion" assessment tool could be seen as an indicator of quality for music education software, using not only individual but also collective data from the instrument. In this sense, the basic intention embodied in Tactus, the computer program used here, is that "emotional regulation" should be a component of the process of learning and training musical rhythm. It is therefore logical that one of the objectives in the process of assessment and decision-making on the quality of the program be the evaluation of these emotions, and also that special attention be paid to this evaluation, given its novelty.

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The study presented here used a methodological apparatus called a "balance of emotions" that allows for the evaluation of emotional dimension with a simple but informative instrumentation regarding the emotional phenomenology provoked by using the educational software. As one goal of this study was to determine which emotions the use of the Tactus software brings into play during the process of learning rhythm, it was therefore felt that this methodology could identify the wide spectrum of both positive and negative emotions involved. It was also hypothesized that this assessment could possibly confirm earlier evaluations from a more traditional perspective obtained from students and experts, after experimentation with the program. Furthermore, it was also hoped that this study would shed some light on future uses of the emotional dimension as criterion for assessing didactic software implementation.

2. Methodology

2.1 Design, participants and pilot

A descriptive-exploratory design was adopted to formulate the "balance of emotions", the assessment instrument intended to determine which emotions, both positive and negative, come into play when a student uses a new rhythm training computer program (Tactus) during 2 one hour sessions of music rhythm training. As part of a comprehensive evaluation (utility, quality, etc.), the participating students selected emotions from a control list of 38 positive and negative emotional responses depending on whether or not the emotion in question was felt during the process of experimentation and learning with Tactus. This written self-report was completed by the participants after using and experiencing Tactus and the data was then analyzed.

Participants (n = 45) included 19 male and 26 female volunteers aged between 18 and 24, from the Bachelor's Degree in Music from the University of La Serena, and from the Bachelor's Degree in Music Pedagogy at the Universidad Metropolitana de Ciencias de la Educación (Metropolitan University of Education Sciences) as well as the Universidad de Chile, both in Santiago.

For the sake of evaluation, the first version of the program was developed and tested for usability and errors by both experts and the researchers themselves, and was eventually refined, becoming the preliminary version of Tactus. After, a pilot test took place in four music schools in order to further refine this beta version as well as the assessment instruments (questionnaires for teachers and students). Taken together, the results of this pilot test were used to modify the assessment instruments, improve the software and evaluate the final version of Tactus.

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LEEME
LISTA ELECTRÓNICA EUROPEA
DE MÚSICA EN LA EDUCACIÓN

2.2 Instruments, materials and procedures

Given that the study of emotions as a research topic is relatively recent within the framework of psychological and educational studies, strategies for measurement in this area are not yet abundant. In this context, it was decided to employ a procedure which consists of exposing students to a control list of 38 positive and negative emotions immediately at the end of the two weeks of study. In this process, the students are told to indicate whether or not they experienced the given emotions in the process of using Tactus. This data is encoded (0 = no; 1 = yes). Given that identifying emotions is a complex task for younger students, these students were told to indicate only the emotions they had experienced while using Tactus, leaving blank any emotion not experienced. With the information from the students, two variables were created (positive emotions and negative emotions), resulting from the sum of each column divided by the total number of emotional responses (19); that is, the number of positive or negative emotions in the control list. This expresses each variable in terms of probability (with values between 0 and 1), indicating the level of positive and negative emotions.

How did you feel during the work with Tactus? Mark with a cross the emotions that you recognize having experienced while using Tactus:

Positive emotions		Negative emotions	
1 Satisfaction / Satisfacción		2 Boredom / Aburrimiento	
3 Enthusiasm / Entusiasmo		4 Frustration / Frustración	
5 Pride / Orgullo		6 Anger / Enfado	
7 Optimism / Optimismo		8 Annoyance / Fastidio	
9. Competence / Competencia		10 Guilt / Culpabilidad	
11 Joy / Alegria		12 Sadness / Tristeza	
13 Relief / Alivio		14 Insecurity / Inseguridad	
15 Serenity / Serenidad		16 Regret / Arrepentimiento	
17 Euphoria / Euforia		18 Isolation / Soledad Loneliness	
19 Confidence / Seguridad		20 Anxiety / Angustia-Ansiedad	
21 Calmness / Tranquilidad		22 Desperation / Desesperación	
23 Perseverance / Perseverancia		24. Tiredness-Stress / Estrés-Cansancio	
25 Companionship / Acompañamiento		26 Apathy / Apatía-Desgana	
27 Confidence / Confianza		28 Lack Of Self Confidence / Desconfianza	
29 Guidance / Orientación		30 Embarrassment / Vergüenza	
31 Attraction / Atracción		32 Disgust Repulsion / Asco-Repulsión	
33 Recognition / Reconocimiento		34 Feeling Lost-Helplessness / Desorientación	
35 Gratitude / Agradecimiento		36 Rage / Rabia-Ira	
37 Stimulation-Encouragement / Estímulo		38 Stress –Worry / Tensión-Preocupacion	

Fig. 1. Control list of emotions (balance of emotions) to be completed by pupils after the learning experience with Tactus.

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The validity of both measures was analyzed through classic quantitative factor study (Principal Component Analysis (PCA). Kaiser-Meyer-Olkin sampling adequacy measures were: positive emotions = 0.797; negative emotions = 0.607. A main components of data demonstrates that there is a main dimension or component which explains a considerable fraction of the joint variance (positive emotions = 26.208%) (negative emotions = 20.102%), with a strong eigenvalue (positive emotions = 4.879) (negative emotions = 2.133). The reliability obtained is sufficient (Cronbach Alpha / positive emotions = 0.810; negative emotions = 0.590).

Tactus, the computer program used here, was designed as a resource to help music teachers teach procedural content related to rhythm. The first basic objective of the software program is to strengthen students' aural recognition and production of rhythmic patterns in measures of two or three beat pulses. In addition, symbolic activities are undertaken (use of musical notation). Each teaching unit includes activities and exercises to develop different types of skills. These activities are of two types: 1) activities of experimentation, in which exercises of perception, memorization, and production of rhythms are undertaken; (2) activities of symbolization, in which two notational systems are used: a) Western musical notation (conventional notation) b) non-conventional notation, which is used as learning scaffolding and gradually withdrawn as the activities progress and the students learn western musical notation (Tejada, Pérez & García, 2011).

The following materials were used in the programme evaluation activities: 1) laptop computers (Fujitsu NetBook - 1 Gb RAM, 160 Gb HD and headphones); (2) the Tactus software (v1.0); (3) "Questionnaire A" for experimental sessions in the first week and "Questionnaire B" for the 2nd week (instruments for collecting data related to other assessment dimensions; not shown here); (4) a checklist of emotions for students. Finally, the students were administrated the research's instrument at the end of the second session of rhythm training.

3. Results

The data analysis shows that the incidence of negative emotions is greatly outstripped by the incidence of positive emotions. Globally, the two variables indicate an average of .370 for positive emotions, with a standard deviation of .212 on the scale from 0 to 1, as compared to .068 for negative emotions, with a standard deviation of .070. This therefore demonstrates a minimum incidence of components of discomfort which, if more present, could result in the abandonment or rejection of the program as a means of learning rhythm. In parallel to the

REVISTA ELECTRÓNICA DE
LEEME
LISTA ELECTRÓNICA EUROPEA
DE MÚSICA EN LA EDUCACIÓN

"balance of emotions", a semantic differential was implemented to collect other data on user attitudes after experimenting with the program Tactus.

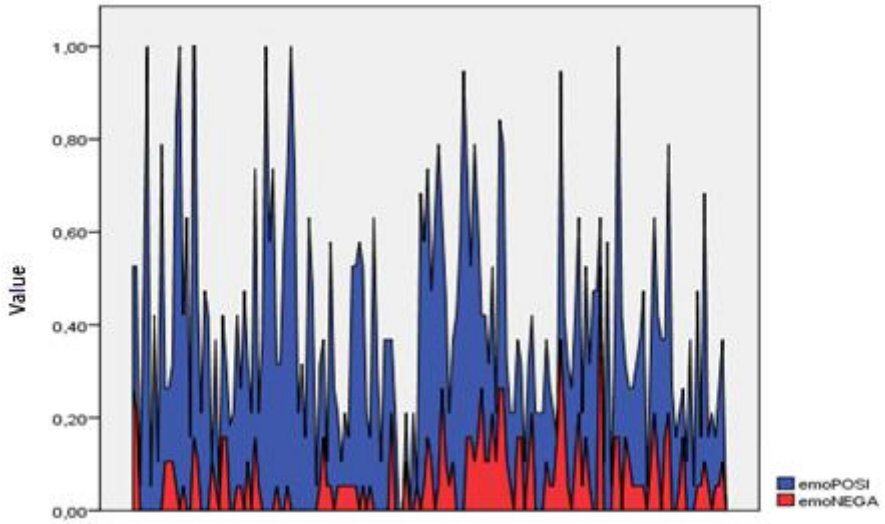

Fig.2 The "balance of emotions": comparison of areas between the degree of positive and negative emotions.

The semantic differential collected indicators which express adherence to the value and also the activity with Tactus: quality, desirability, innovation, satisfaction, appropriateness, organization, user-friendliness, completeness and fun. Together with emotions, these attitudinal aspects theoretically belong to the family of multiple indicators relating to the domain of people's socio-emotional and sentimental development.

It was found in this investigation that these measures correlated positively with evaluation indicators of the quality and merit of Tactus as a rhythmic training computer program. Also, it was possible to establish a criterion of concurrent validity on the "balance of emotions" by analyzing correlations between measures obtained with this instrument and those in each of the semantic differential scales. Additionally, the relationships in this group of correlations allowed for the exploration of how users internally organize their relational (affective-cognitive) process with the learning tool Tactus. Correlations between different scales of the semantic differential and the two emotional states (positive and negative) reveal socio-affective aspects favoured by the students in evaluating the program Tactus. For example, "fun" and "satisfaction" correlated significantly ($p \leq .001$) with the degree of positive emotion (correlation medium-high), as well as to the "goodness" of its value (correlation medium-high) and above all to its "desirability" for personal use (correlation high). As for correlations of these scales with the degree of negative emotions, "innovation" correlated negatively along with "satisfaction".

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NUMBER 31 (JUNE, 2013), PP.107-116
HTTP://MUSICA.REDIRIS.ES/LEEME

Ultimately, this configuration of correlations confirms the underlying assumptions on the concurrent validity of the "balance of emotions" carried out, and also presents a basic view of the users' socio-affective organization in the process of using of Tactus. Below, table 3 shows some correlations between the balance of emotions and other dimensions of the evaluation.

		Degree of Positive Emotions	Degree of Negative Emotions
Global evaluation of Tactus in session 1	Correlation coefficient	,115	-,135
	Sig. (bilateral)	,123	,059
Global evaluation of Tactus in session 2	Correlation coefficient	**,275****	-,158
	Sig. (bilateral)	**,001**	,060
Utility S1	Correlation coefficient	,090	,103
	Sig. (bilateral)	,291	,232
Utility S2	Correlation coefficient	**,234****	-,040
	Sig. (bilateral)	**,011**	,512
Attitude to Tactus	Correlation coefficient	**,399****	**-,265****
	Sig. (bilateral)	**,000**	**,001**

Table 3. Correlations (Rho's Spearman-Brown) between different dimensions of evaluation and the degree of positive- negative emotions.

4. Conclusions and ideas for further discussion

The first conclusion is that experimentation and evaluation of Tactus by students led to varied emotional experiences, which is considered normal according to the logic of the learning process, as students experienced both positive as well as negative emotions. However, positive emotions (joy, tranquility, confidence, enthusiasm, or pride...) were much more prevalent, which in principle leads to the conclusion that the global "balance of emotions" toward Tactus is overwhelmingly positive. Therefore, it can also be concluded that the program generates higher levels of emotional satisfaction than discomfort, which is seen in both the distributions of the areas of these variables as well as in the correlation with the students' attitudes toward this software program, giving a very positive view of the emotional and regulation processes developed during the use of Tactus.

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It can also be assumed that the incidence of negative emotions such as negative stress, fatigue, tension-worry or anger is typical of the process of effort and uncertainty that students experience while becoming familiar with a new learning tool. In this study, an instrument like a checklist was used for self-observation that only provides information on whether a type of emotion appears or not during the process. Perhaps a higher level of refinement can be useful for a more precise approach to emotional balance in certain educational functions and activities of software programs (e.g. using Likert self-positioning scales).

A possible qualitative approach could help evaluate the affective dimension of learning in a much more accurate way, determining the dynamic causal impact of contextual and cultural elements, and especially of the users' different identities, which would also indicate students' individual attitudes and skills for taking full advantage of computer resources in their learning processes. In this sense, the use of student interviews and discussion groups as well as observations of participating teaching staff during the process of using the computer program could make it possible to analyse the students' reactions during the learning process, highlighting the emotional elements in a socio-cultural analysis. In this last sense, current qualitative research on emotions is developing the discursive topic "emotional metaphors" and implementing it with positive results in other empirical studies to determine the subjects' identities and positioning in the psychological process and their educational development supported by e-learning (Rebollo et al., 2008).

Acknowledgements: This work has been carried out as part of the research project "Design, implementation and evaluation of a computer program for rhythm training in music conservatories" (SEJ2007/60405EDU), funded by the Spanish Ministry of Science and Innovation within the National R&D Plan 2004-2007. Thanks to the teachers and students from University of La Serena, Metropolitan University of Education Sciences and University of Chile participating in this project, without whose help this might not have been conducted. Also, many thanks to Larry Fedorowick, reviewer of this text.

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