Creating Inspiring Learning Environments by means of Digital Technologies: A Case Study of the Effectiveness of WhatsApp in Music Education

Michele Della Ventura

Music Academy "Studio Musica", Via Andrea Gritti, 25 – 31100 Treviso (Italy)
dellaventura.michele@tin.it

Abstract

One of the most interesting challenges that many schools are facing today is the introduction of the most recent digital technologies in the learning process. These technologies also turn out to be efficient for the students in terms of motivation. Motivation and the nature of the learning experience are important factors for all students, but particularly for students with dyslexia. This research paper explores the effectiveness of using mobile technologies to support a course titled "Sound Recording" in Music Technology. Specifically, it discusses the effects of WhatsApp mobile learning activities guided by activity theory on students' knowledge management. Results showed that students with dyslexia compensated for their processing deficits by relying on learning strategies and help seeking.

1. Introduction

School finds itself operating in a world of communication that has in recent years been deeply changed by Web 2.0 and by the mobile devices, by the cloud and by mobile computing, a world in which technology "migrates" thanks to the mobile devices into our lives becoming a tool and space for the creation and circulation of culture [1] [2]. Starting from the obvious fact that these technologies were not devised and designed to be used in didactics but they actually do contribute to all those informal learning paths that are typical of the current society of knowledge and they may me integrated in the creation and management of the educational environments, the question that must be asked is how to turn them into a learning environment. To generate this transformation we must meditate on how times, spaces, roles and didactic methodologies change so as to promote the centrality of the learning process rand make students become the key players: from passive consumers of

technologies to responsible authors who, following the teacher's lead, manage to gradually develop an inclination towards research and towards cognitive flexibility.
It is not the simple introduction of technologies into the classroom that can create innovation in didactics: cultural change is needed in order to go beyond the concept of the classroom being the context within which knowledge is passed on, to the learning environment *intentionally* designed by the teacher, in which students use different technologies in an integrated manner, taking advantage of their potentialities and allowing the students to become protagonists in the knowledge building process [3].
It is in this same context that the teacher also has to deal with another issue, namely the one related to the concept of "classroom" intended as a group of students having heterogeneous learning styles. The presence of dyslexic students imposes on the teacher certain didactic choices that help such students and that also turn out to be useful for **all** the other students (the non-dyslexic ones) in order to make didactic practice more efficient, the study method more conscious and the learning more long lasting and more

profound [4]. Yet among these uncertainties there is an element that is still clear and can be easily explained: the importance of motivation in the educational process. It has been already established that technologies contribute to promoting in the student (intended in general, non-dyslexic and dyslexic) the development of behaviors that characterize the affective-motivational ambit [5]: from the traditional technologies, i.e. the digital and telematic ones, to the most recent social technologies, that have the potentialities to become engines able to act positively on the motivation to learn, on the interest, the participation and the commitment.

From the perspective of technologies, the educational scenario had, in these recent years, the chance to receive ever-better-targeted answers, following the diffusion of the tools of the so-called Web 2.0 [6] that witnessed the establishment of the *social network* websites.

This article presents a case study referred to a Music Technologies (MT) teaching project in High Schools specializing in Music. MT is a complex discipline because of the countless technical terms that it deals with: that is why students often experience a feeling of incapacity which leads to disesteem and ultimately to an educational failure.

The main objective of this project was to check on and assess the impact of the use of ICT in the students' learning process: increase the student's motivation in order to see if it corresponds to an improvement of his/her academic results. For this reason it has been decided to introduce the use of WhatsApp in the classroom.

This paper is organized as follows.

Section 2 describes the Social Network. Section 3 describes the tools used for the choice of the Social Network. Section 4 explains the choice of the WhatsApp. Section 5 shows the learning indicators for the assessment of the Learning Process. Section 6 describes the Specific Learning Disabilities (SLD). Section 7 shows the Self-Assessment in the Learning Process. Section 8 shows an experimental test that illustrate the effectiveness of the proposed method. Finally, conclusions are drawn in Section 9.

2. The Social Network

If the Social Networks may be considered a tool "for and of didactics", the first issue to solve for the teacher is the choice of which Social Network to use in the classroom group: Facebook, Twitter, Instagram or WhatsApp, to mention only the most well known. The common feature of these environments is content sharing [7]. The social networks would, therefore, be characterized by [8]:

1) uniquely identifiable profiles, made up of content supplied by the user, content supplied by other users and/or data provided at a system level;

2) publicly structured connections that may be viewed and browsed by others;

3) features that allow the users to consume, produce and/or interact with flows of content generated by the users that are supplied by the existing connections.

However, every Social Network has an intrinsic feature that distinguishes it from the others: on Facebook you can post photos and videos or see the ones shared by other users, or chat with your friends who have signed up; WhatsApp is a fast and easy alternative to the usual text messages (SMS) to "chat", because it can be used on the cell phone; to post the photos you need to use Instagram.

Certain conditions must be implemented [9] [10] for technologies to be used as a learning resource and not to be "neutralized" by a traditional use that subjects them to a transmissive didactics. First of all, real homework must be proposed to students, that should get them involved in resolving problems, in searching for information or in building artefacts (for instance relationships), thus giving more meaning to the needs of knowledge and of commitment. Technologies must help to open the class towards real interlocutors [11] (be them other students to collaborate with or experts to ask for advice), near or far, of different languages, culture or ages.

3. Choosing the Social Network

The choice of the Social Network as a didactic resource cannot be therefore independent of a careful analysis of the class, intended as a group of heterogeneous students as far as learning, but also personal life styles are concerned.

The research presented in this article refers to a pilot project that analyzes the effects on learning and on teaching brought by the implementation of the Social Network in the classroom lesson. The discipline forming the object of the project is Music Informatics, which belongs to the area of Music Technologies. This discipline deals with the analog-to-digital conversion of sound, the tools for the analysis of digital sound, the digital audio formats (lossy and lossless), the Internet and audio streaming.

The main difficulty stemming from it is the large amount of technical/scientific and conceptual terminology.

The choice of the Social Network was done by analyzing the results of an (ex-ante) survey carried out in class. The students were asked to answer the questions in a questionnaire (see example in Table 1), meant to explain the "affective-motivational" relationship everyone of them has with the technologies. Every question offered the possibility to choose an answer, to indicate if it represented a useful or an accessory element in everyday life as a person, and to assign a numeric value (from 0 to 10) representing the importance acknowledged on a personal level (where 0 meant more importance acknowledged for the objective/personal factor and 10 meant more importance given to the affective/social factor).

Table 1. Excerpt from the ex-ante questionnaire.

Question	Useful/Accessory element	Score (0-10)
Use of the internet: 1) often 2) enough 3) seldom		
Use of the internet: 1) on the computer 2) on the tablet 3) on the cell phone		
Use of the internet to: 1) consult books 2) read newspapers 3) video-calls 4) other………..		
Have you participated in a discussion forum? 1) often 2) sometimes 3) never		
Have you participated in a chat? 1) often 2) sometimes 3) never		
Have you ever been a part of remote workgroups supported by web technologies? 1) YES 2) NO		
Do you think you could participate and have good results in: 1) talks 2) research groups 3) open activity groups		
In a workgroup: 1) you collaborate equally 2) you tend to be the leader 3) you prefer to follow the others		
…	…	…

The results were represented diagrammatically (figure 1) by a tool called "Virtual Show & Tell" [12] and analyzed to be able to choose the Social Network. The "Virtual Show & Tell" tool consists of a Cartesian diagram that associates the emotional/functional aspect (that is if the answer has a personal or useful value) with the personal/social aspect (that is if the answer has a personal value or is open to many people). The various answers are represented by colored circles the size of which changes based on the percentage of people that gave the same answer and the color of which changes based on the answer representing a useful element (black) or an accessory element (red) in that specific person's everyday life.

Areas containing elements with general common features may be therefore highlighted on the diagram. In our case, for instance, 4 areas may be highlighted:

1) *Utility*: gathers all the elements needed for complementary functions such as word processing, image editing…
2) *Needs & Procedures*: groups all the elements referring to personal tastes;
3) *Devices*: groups all the elements related to the technological equipment being used;
4) *Communication*: gathers all the elements referring to the information processing, transformation and transmission systems.
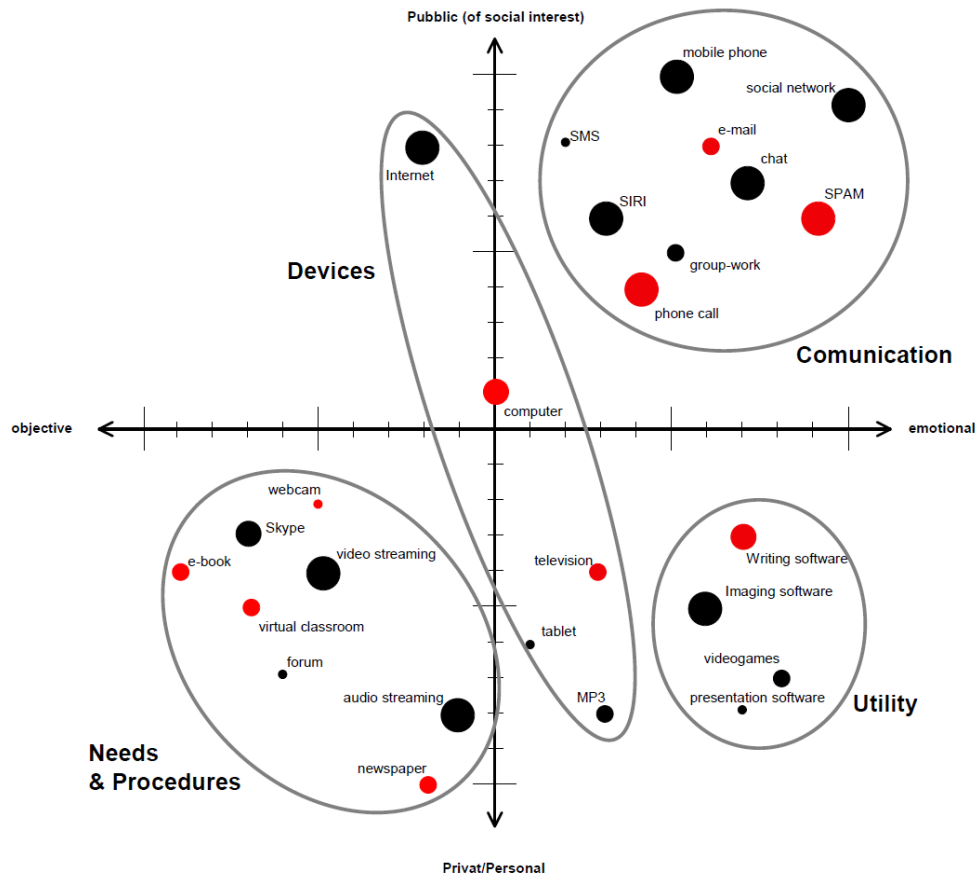
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Figure 1. Diagram representation (Show & Tell) derived from the questionnaire analysis.

From an analysis of these elements you may note how the students' attention was directed towards the affective/social area. Communication in chat and on Social Networks (rather than the SMS) prevails, through the use of the cell phone (rather than the computer or the tablet), communicating with "buddies" through voice messages (SIRI) to the detriment of text messages; they use the Web a little to find information (e-books, articles, newspapers...); they use the text processing and graphic software only for strictly personal purposes. From these considerations and based on the classroom group structure (that included some dyslexic students) the choice was made to use WhatsApp as a work tool.

4. Why WhatsApp?

WhatsApp (from the English phrase "What's up?" meaning "What's new?") is an instant messaging application for smartphones. It allows users to exchange images, videos, and audio or written messages using their Internet connection. WhatsApp has positioned itself as a superior alternative to SMS messaging, which can be very expensive when used in foreign countries due to roaming charges; WhatsApp, in contrast, relies on the active Wi-Fi network.

The general benefits of using WhatsApp instant messaging in the blended mobile lecture are as follows [13] [14] [15]:

- WhatsApp instant messaging facilitates online collaboration and cooperation between online students connected from school or home in a blended mobile lecture;
- WhatsApp is a free application that is easy to use;
- Provide online students with the ability to exchange text messages, images, videos, and voice notes to their social network or group and contacts;
- Information and knowledge are easily constructed and shared through WhatsApp instant messaging [16];
- WhatsApp provides students with the ability to create a class publication and thereby publish their work in the group [15] [16];
- Groups connected to WhatsApp instant massaging can share learning objects easily through comments, texting and messaging. Discussions are related to the course content taught 100% in-class;
- Provide students or instructors with the ability to create a group (social network group) that supports

the social interactions: members can engage in discussion forums [17] [18];

- WhatsApp provides the ability for students to send messages without limits;
- Students using WhatsApp can message one another through texts, images, videos, and so on.

Last but not least, WhatsApp seems to be useful as a tool for the dyslexic student. The possibility to send and listen to audio messages rather than text messages helps the students who have trouble with reading; the possibility to listen several times to the same message helps them to learn; the possibility to dictate a message (SIRI) rather than write it down also compensates the writing difficulties.

5. The Role of Assessment in the (in-itinere) Learning Process

In this new context where students learn through the Social Network, the central role is played by the operations of **monitoring and analysis**. Without them the online environment will barely be able to emancipate from a perception that envisages it only in ancillary terms with respect to the education system and not, as it should be, as an **element integrated** into it and, actually, able to guarantee **added value to it** [19] [20] [21]: the monitoring and analysis of the learning processes assume an indispensable role for the development of quality processes. In this context emerge the necessity to ponder on the relationship that the technologies have with didactics so as to monitor both the changes in the learning habits and styles of the students [22].

On the base of the above considerations, in Table 2 there are some indicators that the teacher could consider to evaluate the (in-itinere) learning process.

Table 2. Indicators to evaluate the (in-itinere) learning process.

Indicators referred to the internal process	- Use of informal language to seek dialogue - Construction of simple sentences for the message - Use of the technical terms in simple sentences - Ability to cooperate with the group members - Ability to encourage the group members to participate in the dialogue - Ability to support the group members - Intensity of the cooperation among the members - Take part in different dialogues - Reduction of the times needed to find the adequate solutions - Creation of a shared repertoire of standards, methods, best practices - Ability to use resources optimally - Increase of the empathy among the group members
Indicators referred to the learning and growth process	- Number of messages - Development of didactic interaction: clear and defined - Ability to identify the problem - Ask questions based on the problem - Quality of the formulated hypotheses (to solve the problem) - Number of ideas to solve a problem - Number of the resources found and shared related to the (similar) problem - Number of messages in order to learn together - Quantity of products realized - Increase of the capacity to use again resources and knowledge - Ability to use the information in different activities
Indicators referred to the user's perspective	- User satisfaction degree - Reduction of the number of complaints from the group members - Increase of the awareness of the group work - Capacity to retain the group members - Activity sharing approach - Increase of the amount of activity - Increase of the self-worth

The learning indicators assume a central role especially when the group class is heterogeneous, that means characterized by non-dyslexic and dyslexic students. In this case the teacher must be aware to the different learning styles, in order to reach the aim of the discipline.

6. Dyslexia: Specific Learning Disorder

Dyslexia is defined as a **Specific Learning Disorder (SLD)**: a reading disorder which affects intelligent people who find it difficult to automatize the graphic signs interpretation process [23] [24]. This decoding difficulty comes with a deficit in the reading speed and accuracy, which has an effect, in most cases, on the comprehension of the written text [25].

It is crucial to underline that dyslexia is neither caused by a mental retardation of the intellect, nor by environmental issues and sensory deficit issues. Dyslexic students can write and read, but they manage to do so using their capacities and energies at the maximum, given that they cannot do it automatically. They grow tired quickly, they make errors, fall behind, do not learn [26].

One of the major issues of the dyslexic students is the lack of autonomy in the learning process, which leads the individuals to disesteem and educational failure [27].

To reach **educational autonomy,** one needs:
1. adequate compensatory and auxiliary tools;
2. good motivation;
3. a favorable and stimulating environment.

When teaching it is essential to develop the aspect of the student's motivation (be the student non-dyslexic or dyslexic) to participate in the academic activities both through personalized approaches, i.e. based on teaching customization, and through approaches based on techniques such as brainstorming or problem solving. IT, therefore, is an irreplaceable opportunity for individuals affected by SLD, inasmuch as by presenting itself as a vicarious tool, it allows a complete usage of the intact abilities, such as the intellect and fantasy. The computer allows a psychological advantage as well which increases security and trust in the individuals affected by SLD and IT actually assumes a primary role in order to provide the possibility to build compensatory and qualifying learning paths.

7. The Self-Assessment in the (in-itinere) Learning Process

Self-assessment is a crucial moment. Involving students in assessing their learning progress is highly positive and very engaging for students [28]. This kind of assessment encourages students to take ownership of their work through reflection and discussion about the learning process and results [29].

If a student can identify his/her learning progress, this may motivate further learning [30].

Self-assessment permits:
- reflection on one's own learning.
- a focus on process.
- student responsibility and independence.
- to satisfy diversity of learning styles.
- to shift the focus from something imposed by someone else to a potential partnership.

Table 3 shows a self-assessment grid for the students, based on all the above consideration presented in this paper.

Table 3. Self-assessment student grid.

Strategy	Always	Often	Sometimes	Never
I listen to the messages of the group members				
I answer the group members' questions				
I try to answer the questions in my own words				
I use images to explain a subject				
I ask for help to the group members				
I try to help the group members				
I make use of suggestions and feedback from the group members				
I try to produce an outcome according to the task achievements				
I take down new words or notes so I can use them later on				
I check that the group members understand me when I speak (explanation or request)				
When I'm listening to a message I stop once in a while and go over what I have listened				
When I find a difficulty to understand a message I do not give up to ask help				
Others:				

8. Application and analysis: Research Method

The research presented in this article (see paragraph 3) was conducted for a time period of 4 months (from February 2015 to May 2015) and it engaged the third grade of the Music High School, with a total of 24 students (11 girls and 13 boys) of which 2 affected by dyslexia.

In the first month of work the students participated in the lessons in the classroom listening to the explanations of the teacher and only taking notes: no text or lecture notes were given to them. At the end of the month, an examination was passed in the classroom with an open-ended questions test, identical for non-dyslexic and dyslexic students.

The result supplied important (and at the same time expected) indications so as to be able to continue with the project. In particular, the following data emerged (figure 2):

1) 75% of the students (18 students) answered all the questions (none of the dyslexic students);
2) 46% of the students (11 students) were able to make connections between different concepts (none of the dyslexic students);
3) 30% of the students (7 students) reported examples in the answers in support of the explanation (of which 1 dyslexic student).

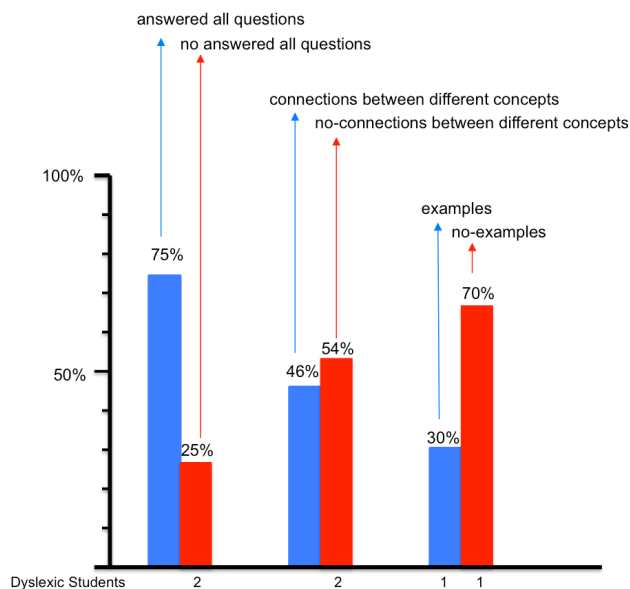The indicated parameters do not refer to the correctness of the answers or of the examples.

Figure 2. Results of the first examination.

In the following months, two work groups were created, each made up of 12 students, dividing the students who had high academic performances equally between the two groups. The two dyslexic students were inserted each in a different group. The students were allowed to use WhatsApp for personal study.

At the end of the project a classroom examination was carried out (assigning everyone the same test), the results of which exceeded the expectations (figure 3):

1) 88% of the students (21 students) answered all the questions (of which 1 dyslexic student);
2) 71% of the students (17 students) were able to make connections between different concepts (none of the dyslexic students);
3) 96% of the students (23 students) reported examples in the answers in support of the explanation (of which 2 dyslexic students).
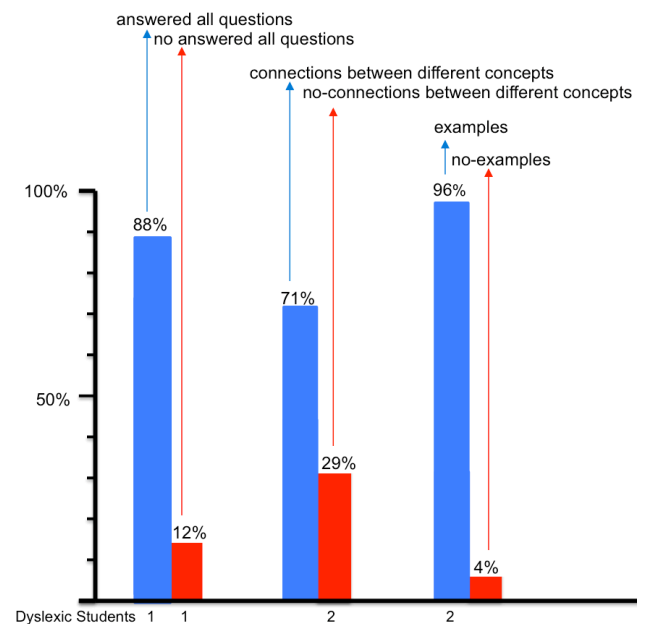

Figure 3. Results of the second examination.

Besides the numeric results that can be read in the diagrams, one of the most important things that emerged refers to the increase of the number of students that answered all the questions and the use of the examples in the same answers: the students used WhatsApp to share the notes, using a simple and precise language in order to meet the needs of the group.

There was a substantial improvement, as far as the two dyslexic students are concerned, to the point of managing to pass the final examination with a mark higher than 60%, considering that it was not (as already mentioned) different from the test of the other colleagues. Their oral presentation improved as well, the dyslexic students managing to formulate discourses full of examples, rather than mere definitions.

The learning improvement also appeared for students who already drew a high profit: the process was positive for

them as well, inasmuch as they learned to select the information they found based on the group members (particularly with reference to the dyslexic students) .

9. Discussion and Conclusions

This paper has presented an analysis of the results of a research project involving social interaction via WhatsApp. The introduction of WhatApp was truly satisfying: there was a positive and significant impact both on the learning and on the teaching which was subsequently mirrored by the results reached at a didactic level.

It was determined that the technologies must be understood as a complex of artifacts that may boost didactic communication and have an impact on the teaching-learning processes. The new technologies are not, as a matter of fact, the goal, but the means: they allow a facilitation, an enhancement of a process that leads to more significant learning forms and that allows organizing the assimilated knowledge in a stable way and integrating them into what we already know.

The technologies within an *intentional* planning by the teacher may promote the shared knowledge building, the interaction with the information content, but also the customization of the learning paths and strategies and the active and also creative learning of the different disciplines.

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