

# Motivation-Driven Educational Game Design: Applying Best Practices to Music Education

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## ABSTRACT

Building upon research on motivation theory, we provide insights on how video games can be framed as expert tools that naturally reconcile learning and fun, a worthy goal since students are forced to where players volunteer, namely learning. Our main contribution is to suggest best practices rooted in psychology and motivation theory that we believe should be used when designing educational games.

As a case study, we illustrate this approach by looking at the design of our ongoing *Cha-Luva Swing Festival* project, a video game dedicated to music education. Its overall pedagogical goal is to spur the players' curiosity and creativity by enabling them to easily play music using gamepads as musical instruments. This example perfectly illustrates our results, since motivational lapses due to instrumental limitations often lead to resignation and surrender.

## Categories and Subject Descriptors

K.3.1 [Computers and Education]: Computer Uses in Education; J.5 [Arts and Humanities]: Performing arts—*Music*

## General Terms

Design, Experimentation, Human Factors

## Keywords

Educational Games, Motivation, Learning, Fun, Music

## 1. INTRODUCTION

Video games are more and more considered through their educative potential since they gather promising features: interactivity, user-centered design and state-of-the-art computer technologies. They lead to high-quality multi-sensory rendering environments in which students can experience "learning by doing". But the main reasons for this increasing interest are the medium's success, the motivation of players and their deep engagement while playing.

In this paper, we examine how motivation-driven design influences learning and outline the new educative situations video games offer. We intend (1) to show that motivation and learning are closely related values that foster each other and (2) to suggest general guidelines, or best practices, for redesigning learning situations through fun.

The structure of this paper is as follows. After this introduction, we examine, in Section 2, the impact of the motivation phenomena in education and games. This leads us to specify, in Section 3, best practices that we believe should be applied when designing educational games. In Section 4, we test this strategy in a musical video game that intends to reach one of the crucial goals in music education: balancing pleasure and desire. Section 5 concludes.

## 2. MOTIVATING LEARNERS

The term *motivation* describes the reasons that explain or justify actions. For Fenouillet [6], its general use may convey the enigmatic part in individual success or failure. We take a closer look, in this section, at this key ingredient in the learning process.

### 2.1 Self-Determination Theory

In the field of psychology, cognitivism has renewed the study of the human mind on various aspects: language, emotions, memory or motivation. If conceptual models and their associated semantics have bloomed during the second half of the twentieth century, no global theory yet gathers the various motivational phenomena [6].

In this paper, we have chosen to look at motivation through Deci and Ryan's Self-Determination Theory (SDT) [3], since it is particularly expressive in the fields of education and, as we will see, gaming. Within SDT, the humans' social development is driven by the satisfaction of innate psychological needs for *competence*, *autonomy*, and *relatedness*. This general framework of human motivation has to be coupled to one's innermost interests in order to explain self-determined behaviours, encountered when people act "with a full sense of volition and choice" [3]. SDT is related to the following classification of motivation qualities [2]:

**Intrinsic motivation** *pushes* us to act freely, on our own, for the sake of it;

**Extrinsic motivation** *pulls* us to act due to factors that are external to the activity itself, like reward or threat;

**Amotivation** denotes the absence of motivation.

Thus, in SDT, high degrees of motivation require satisfaction of the innate psychological needs and are directed towards what people find interesting (intrinsic motivation) or important (well-internalized extrinsic motivation) [3].

## 2.2 Motivation in Education

Instinctively, motivation seems to be a key asset to get actively involved, in time and mind, in the learning process: “a motivated learner can’t be stopped” [16].

More precisely, Vallerand et al. [17] showed that sustained participation is closely related to intrinsic motivation. Fenouillet [7] points out that, if motivation does not affect short-term memory characteristics like its capacity or persistence, it strengthens attention and selection of interesting information. Motivation also leads to the activation of efficient cognitive strategies for long-term memory issues like monitoring, elaborating or organizing information. On the opposite, resignation and amotivation have negative results on memorization and personal development.

Satisfying Deci and Ryan’s innate needs increases the chances of experiencing an efficient learning. Yet, traditional education usually fails to provide a proper environment at the institutional level:

**Competence.** By assigning courses without neither critically discussing their interest nor situating them in the long-term objectives of education (citizenship, social integration, professional skills, discovery of other cultures, etc.), it creates no needs for competence.

Also, by repeatedly rating weak students with bad grades, teachers don’t provide useful feedback that could help students find a proper path to competence;

**Autonomy.** By focusing on constraints (evaluation, homework, schedule) and giving few responsibilities to students, conventional teaching reduces autonomy, although the influence of constructivism tends nowadays to expand and diversify learner-centered pedagogical situations;

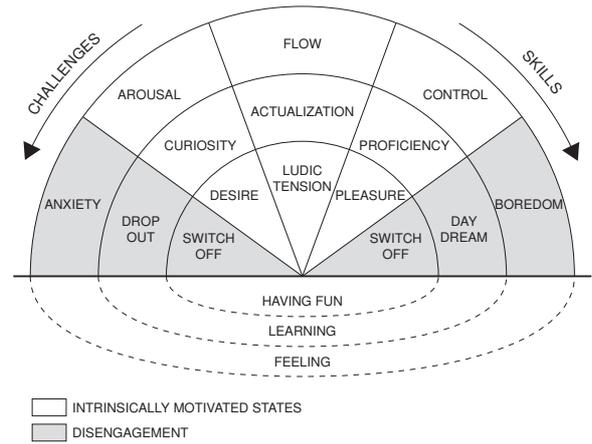
**Relatedness.** Nonetheless, on the positive side, the school social environment usually helps fulfill one’s needs for relatedness.

At the individual level, students sometimes focus their attention intrinsically, thanks to their interest in a special theme or the pleasure to listen to a good lecturer for example. However, unpleasant emotions (like anxiety or lack of self assurance) have a global negative impact on one’s motivation.

For an illuminating and strikingly contrasting approach, let us turn to “a place where motivation itself is the expertise” [16].

## 2.3 Motivation and Video Games

Why is motivation so effective in video games? It mostly deals with fun, a potent source of intrinsic motivation. Many authors have written on the subject [8, 11, 12, 13, 14]; we suggest here an organization of the fun factors they pointed out in two poles - pleasure and desire - and their resulting *ludic tension* [10]:



**Figure 1: Intrinsic motivation as a balance between challenges and skills.**

**Pleasure** comes from fantasy [13], control [14], power, creation, social interaction, immersion and comedy [8], direct system response and experience of effectance [11], emotions or achievement of desire;

**Desire** comes from challenge and curiosity [13], problem-solving and competition [8], escapism and competence [11];

**The ludic tension** comes from discovery [8], conflict, suspense and relief [11], learning [12], surprise or narration.

This ludic tension describes the unstable whirlwind existing between pleasure and desire, chance and strategy, rules and freedom, reality and fiction [10].

Looking at motivation through the impact of challenges and skills, we introduce, building on Novak’s work on flow<sup>1</sup> [15], the notion of parallelism between fun and learning: curiosity and proficiency as cognitive desire and pleasure (see Figure 1). In our model, intrinsic motivation isn’t restricted to flow, but also encompasses arousal and control. These are temporary regulation phases that reflect the dynamics of a learning curve, which has to be constantly renewed and balanced to maintain the players’ engagement.

Thus, the case for video games in education is not about using unrelated miraculous remedies that awake learners’ interest; we rather see fun as highly motivated learning, where evolving desires are nurtured by effective pleasure.

## 3. DESIGNING EDUCATIONAL GAMES

The overall goal of educational games is to draw the student learning curve dynamics nearer to Vygotsky’s zone of proximal development<sup>2</sup>, with games in lieu of teachers as

<sup>1</sup>“the holistic sensation that people feel when they act with total involvement”, see [1].

<sup>2</sup>“the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers”, see [18].

knowledge mediators. The pedagogical mediation is then replaced by a pedagogical mediatisation, hoping that learners will be pushed by their own motivations rather than be pulled by teachers.

Yet finding the proper recipe for success can be a difficult task, as can be seen in the following failed attempt.

### 3.1 A Counter Example: Edutainment

Edutainment software intends to use video games' technology for educational purposes, but is in fact rarely designed to be playable. The disappointment is all the bigger than one could have believed that he/she was going to have fun. The main characteristic that differentiates edutainment and video games is interactivity, because, the former being grounded on didactical and linear progressions, no place is left to wandering and alternatives. Looking at the educative part, edutainment often fails in transmitting non trivial (or previously assimilated) knowledge, calling again and again the same action patterns and not throwing the learning curve into relief.

The case for video games in education is thus more about creating meaningful, interactive and challenging worlds involving the user as the conductor of his own development.

### 3.2 Best Practices

We believe that Deci and Ryan's framework, together with the link we suggested between fun, intrinsic motivation and learning, logically leads to introducing a set of best practices for successful education game designs that take the most out of video games by simply respecting their nature.

Among the various motivation-based synergies between learning material and video games, the most important are:

*Reify values into rules (competence).* Game designers must decide which values (moral, scientific, aesthetic, etc.) the game should express, and embed them in the rules, one rare immutable part - in most cases - of games. The goal is to convey knowledge in interactions rather than static data (as in edutainment).

*Give power (competence).* Players must be provided expressive ways to confront with and test rules, experiencing meaningful feedback to their input.

*Tune usability (competence, autonomy).* Entry barriers that go against the players' urge to practice the game, such as the technical difficulty of the gameplay or the game's gender bias, should be leveled.

*Deraile the gameplay (autonomy).* Designers should provide gamers with alternatives and space instead of constraining them in a predefined trajectory that hinders audacity, creativity and exploration - key aspects of fun, and learning.

*Favor communication (relatedness).* Games should take advantage of all existing communication vectors for collaborating, negotiating, plotting, competing, etc. Game-related issues can be discussed by players during the game, fostering both game strategy and broader socialization, possibly continuing after the game.

### 3.3 Towards Seamless Evaluation

Great care has to be given to the sequential embedding of new information and challenges in the gameplay to make the learning curve reveal its rich semantics. We consider that a positive slope of the learning curve requires players' ability to be renewed and adapted to intellectual conflicts.

If an educational game is well suited to the values it conveys, the player's progress should reflect his development regarding the learning material. This way, games provide a natural and stealth evaluation mechanism in which *levels are grades*. This automatically removes the negative aspects of external rewards on intrinsic motivation observed by [3], since they deviate the students' focus from skill acquisition per se.

## 4. CHA-LUVA SWING FESTIVAL

For Guirard [9], music can become an "incomprehensible wall" for discouraged learners, thus providing us with an interesting challenge for new educational approaches. Our aim here is to explore, using motivation theory as a guide, innovative pedagogical ideas that respect the essence of music and the nature of games.

### 4.1 The Case for Music Education

In a previous article [4], we discussed how traditional music education usually fails in favoring play without requiring considerable preliminary work to learn music theory or instrumental technique. As a matter of fact, learners often experience unpleasant emotions coming from reproaches addressed to themselves or their parents, evaluations, stage fright before performances or natural shyness during public expression, etc.

In our terminology, conventional music education doesn't provide balance between one's desire to play well and the pleasure he/she experiences when playing. Our pedagogical goal here is thus to provide meaningful and playable ways of producing music that should help music students balance technical work and creative expression.

### 4.2 Game Presentation

*Cha-Luva Swing Festival*<sup>3</sup> is grounded on a jazz duet metaphor: it gives users the opportunity to play the accompaniment and solo parts of various tunes, using dedicated musical controls that help players become good *pianopadists* and *saxopadists*. The video game shares one part of its gameplay with titles such as *Samba de Amigo* or *Donkey Konga*, in which one has to follow a score and reproduce the right sequences of moves.

But in our game, in addition to rhythm, players also have to deal with chord colors (for the *pianopadist*) and melody scales (for the *saxopadist*). Moreover, improvisation phases and free parameters (like the choice of chord voicing) enlarge the playing field; they allow players to experience creativity and to discuss and criticize their musical choices, thus forging a duet spirit.

A work similar to ours' has been conducted using joysticks to control sound synthesis [5], but our aim here is to manipulate melody and accompaniment to teach high-level musical concepts. The overall goal is to allow students to experience musical situations they couldn't technically afford otherwise, spurring their curiosity and giving them a glimpse of what

<sup>3</sup>*Cha-Luva* is an invented word whose etymology mixes bossa-nova, blues and jazz.

they will be able to enjoy once they master their actual instrument. Using Deci and Ryan's terminology, we hope to provide a proper environment that helps *internalize* one's motivation.

### 4.3 Best Practices in Cha-Luva

*Cha-Luva Swing Festival* embodies the best practices we specified above:

*Reify values into rules.* Mixing constraints with free improvisation phases, we provide a rich playing field that fosters creativity and gives a glimpse of what actual jazz improvisation is.

*Give power.* "Learning by doing" is mapped to learning by playing music, using a mapping of geometric gamepad symbols to musical concepts.

*Tune usability.* We use a progressive gameplay to gently introduce musical concepts, moving from instinctive rhythmic patterns to more abstract notions such as chord voicing.

*Derail the gameplay.* Free improvisation phases aren't evaluated (they are, indeed, by the players themselves), which enables musicians to wildly wander on the music track.

*Favor communication.* Real-time music production fosters discussion, critics, attentive and reciprocal listening, rigorous play and shared fun among players.

Of course, the game offers other motivation-boosting aspects, such as making players aware of different music styles and artists or building upon human nature's appeal to rhythms.

### 4.4 Project Status

We are currently developing the *Cha-Luva Swing Festival* video game and intend to release a free version in a few months. The game, built upon Java and Simple DirectMedia Layer technologies, will only require a pair of USB console-like gamepads and a multimedia PC.

## 5. CONCLUSION

The essence of fun is a ludic tension that conveys the permanent evolution of one's own pleasure, desire and abilities. Video games are examples of user-centered designs that motivate through learning, arousing players' interest (desire to act) and giving them the power of ample expression (pleasure to act). We suggest that motivation theories can thus help designing educational games.

Using Deci and Ryan's Self-Determination Theory as our guide, we provided some examples of motivation-based best practices, focusing on competence, autonomy and relatedness traits. To illustrate our approach, we applied them to the case of music education, via the *Cha-Luva Swing Festival* project, which intends to foster collaborative musical creation using gamepads as appropriate instruments. The project challenge is to spur players' musical curiosity and increase their motivation for traditional instrument study, helping them overcome learning plateaus.

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