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**NINTENDO SWITCH AS A WAY TO WORK
COORDINATION AND MOTOR SKILLS**

Presentado por: Juan Ángel de Miguel Otero

Tutelado por: Nuria Sanz González

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Abstract

Coordination and motor skills are important skills throughout our lives, as they will help us to develop as people and in society. That is why it is important to be aware of them and to know what advantages and disadvantages they can generate.

New technologies and video games are very present in today's society; although their purpose is mainly recreational, they can also be used to improve motor skills and coordination.

This work is based on the use of the Nintendo Switch video console and, more specifically, through the Nintendo Switch Sports and Just Dance video games as educational tools in the intervention with children with motor impairments.

The main objective of this dissertation has been to work and improve the skills and abilities of these users in a dynamic, entertaining and participatory way by analysing what each video game can contribute.

Key words

Coordination, motor skills, videogames, Nintendo Switch, learning, Dyspraxia, gross motor skills, fine motor skills

Resumen

La coordinación y la motricidad son habilidades importantes a lo largo de nuestra vida, ya que nos ayudarán a desarrollarnos como personas y en sociedad. Por eso es importante conocerlas y saber qué ventajas e inconvenientes pueden generar.

Las nuevas tecnologías y los videojuegos están muy presentes en la sociedad actual; aunque su finalidad es principalmente lúdica, también pueden utilizarse para mejorar la motricidad y la coordinación.

Este trabajo se basa en la utilización de la videoconsola Nintendo Switch y, más concretamente, a través de los videojuegos Nintendo Switch Sports y Just Dance como herramientas educativas en la intervención con niños con discapacidad motora.

El objetivo principal de esta tesis ha sido trabajar y mejorar las habilidades y destrezas de estos usuarios de una forma dinámica, divertida y participativa analizando lo que puede aportar cada videojuego.

Palabras clave

Coordinación, habilidades motrices, videojuegos, Nintendo Switch, aprendizaje, Dispraxia, motricidad gruesa, motricidad fina.

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1. Introduction

It is important to be coordinated in order to be able to carry out the different tasks we are given. But then we do not carry out and implement activities to work on it and sometimes it is not so much taken into account in the classroom. Although we are not aware of it, it has a great impact on many processes and activities not only inside but also outside the classroom.

Motor skills are often thought of as the ability to perform movements. What we do not realise, however, is that it is through motor skills that various tasks can be performed easily and productively. We must imagine the body as a large machine that works with various gears and mechanisms that must be coordinated in order to function correctly. In order to do this, it is necessary to learn and execute the different movements correctly, in order to adapt to the environment and the situations that arise.

That is why, with this work, I want to be able to approach and understand how to work and improve coordination and motor skills. Poor motor skills can interfere in the development of our students and in the acquisition of various strategies and processes that are fundamental for correct growth.

In recent decades, society has changed at an unimaginable pace. This change has also altered the way we are and the way we see the world. Today's world is fully in the technological age, in which people are bombarded with thousands of stimuli every day. This new era has brought great advances, but it has not all been good. It has also brought other problems such as: sedentary lifestyles, obesity, personal cognition problems, among others.

In the past, most children used to go to the park to play with other children, but nowadays, with the advent of video games and game consoles, they opt to stay at home and play remotely with their friends. Ideally, however, they should be able to go outside and have fun with their friends. This is often not possible. Therefore, I have decided to work on coordination and motor skills using video games, and to take advantage of this cooperative and competitive nature to work in a fun and entertaining way.

For this reason, I have decided to work with the Nintendo Switch. This console presents an infinite number of games and modes for all tastes. Therefore, I will analyse and test several games. I will talk about skills such as hand-eye coordination, foot-eye coordination, fine motor skills, gross motor skills and how we improve and train these skills by practising and playing these video games.

2. Rationale

During my training period in schools, I have observed children who have difficulties in the coordination of their movements, manipulation of objects and many of them have problems with reading and writing, sequencing and planning of actions, problems with spatial conception, executive functions and postural problems.

All of the above has led me to consider how I can help these children to improve their difficulties in a playful way, involving the family since the work is done at home, and taking advantage of their play and leisure time so that the child can work, improve and attenuate these problems by reinforcing their school activities. I have tried to take advantage of both the boom that ICTs are having right now in the world of education, and the time that children invest in the world of virtual games, looking for and studying games that help them to improve their motor skills.

This work first tries to explain the basic concepts of coordination and motor skills, giving a theoretical basis to understand how the use of the video game console and the selected games can help or collaborate in achieving the objectives of improvement in this motor area.

In this work we have tried to work on general competences of the degree of Primary Education, such as:

- To convey information, ideas, problems and solutions to both specialist and non-specialist audiences.
- To have the ability to gather and interpret essential data (usually within their area of study), in order to make judgements that include reflection on essential social, scientific or ethical issues.

In addition to specific competencies such as:

- Identifying learning difficulties, reporting them and collaborating in their treatment.
- Knowing the technological aids that contribute to improving the learning conditions and quality of life of students with special and specific educational needs.
- Knowing and applying information and communication technologies in the classroom.
- To be able to use and incorporate information and communication technologies appropriately in teaching-learning activities.

3. Theoretical framework

Coordination and motor skills fully affect people's daily lives, so it is important that we know the different types of coordination that exist, the benefits of working on them and the problems that can be caused by their poor development or acquisition.

In the theoretical framework, I intend to teach basic concepts to understand how they work. I will also explain the benefits of learning by playing. In addition to the different video game consoles, I will explain their advantages and disadvantages. Finally, I will talk about video games and how they can help children to acquire values and useful skills for their lives.

3.1 Motor skills

Motor skills are those actions that are performed to respond to the needs that are presented to us. Basic motor skills are those that are used on a daily basis: running, jumping, crawling, climbing, receiving...

Motor skills are both hereditary and acquired, so that good work and learning of these skills will help them to develop appropriately. For this reason, they should be worked on from an early age through games and activities. There may be cases in which children do not have good basic motor skills and have problems when it comes to relating to other people and the space around them.

There are two main types of motor skills

Gross motor skills: according to Fernández (2010), gross motor skills include the large muscle groups. These make our movement, balance and posture possible. Thus, this type of motor skills involves several muscles working at the same time. An example would be crawling, running, walking... Gross motor skills are more related to the child's participation and development in social relationships as they help them to have greater interaction and teamwork, because they are related to: balance, coordination, reaction and body awareness. Many of these tasks that we do every day involve motor skills but we don't realise it because we do them almost automatically.

Therefore, a person with poor or limited motor skills can have problems. These range from back problems, joint and muscle pain or inability to perform different tasks, among many others.

Fine motor skills: According to Garza (1978), fine motor skills are those activities that require great precision. Therefore, it is not necessary to involve large muscle groups. For example, in order to pick up a pencil or thread a needle, subtle and coordinated movements are required. This is why it is often more complicated for children. This fine motor skills are very important for the development of children, thanks to which they can write, draw, cut out...

While the previous motor skills were more related to social relations, this one could be said to affect the child's schoolwork.

There are a multitude of resources and games to work on fine motor skills. For example, using play dough, sand, puzzles, small toys, etc., will help to improve dexterity and coordination. The activities and resources used must be attractive and appropriate for the children. Do not propose the same activities and games for all levels, they should be adapted to each level and situation to give the right result for each one. These skills are acquired and improve with practice, so the more they are worked on, the better and more skilful the pupils will become.

Motor skills can also be divided into:

Locomotor: those that involve moving the body from one point to another. Within this group we find: running, jumping, crouching, climbing...

Non-locomotor: these are those that involve control and management of the body, but unlike locomotion, they do not require movement of the body. Some examples of this group are: turning, hanging, balancing, standing...

Manipulative: these are those that involve catching or receiving objects. Among them we find precision throws, distance throws, receptions, saves, clearances...

3.2 The importance of Coordination.

Coordination is the process by which different parts or elements work together to achieve a common goal. Coordination is very important throughout our lives; it facilitates and enables us to perform actions in such a way that we have to make the least effort to achieve our goal.

According to Munoz-Rivera, (2009) coordination is to be able to drive and organize with precision, efficiency, economy and harmony the motor behaviour to achieve a specific objective, it is necessary to act on the nervous system, that conjugates all the feelings and sensations necessary for a correct move.

Thus, motor coordination is an ability that develops throughout our lives and enables us to perform complex movements easily and efficiently. This coordination improves over the years through practice, learning and experience. Motor coordination makes it possible to perform different activities such as walking, running, climbing, crawling, writing and even reading. Thus, this capacity for good coordination allows for greater health and well-being.

In order to be coordinated, different factors must be taken into account to provide the best response to the need or task at hand. Moreover, in order to carry out movements with

precision and efficiency. It is necessary to follow an order, otherwise the movements and actions will be clumsy, slow or impractical.

In this capacity, different elements must be taken into account such as: strength, speed, direction, posture and coordination of the sequence.

Strength coordination: This includes the amount and precision of force that the muscles and joints must apply to perform the task in the best possible way.

Some exercises that can be done at home to work on it are: Carrying objects of different sizes and shapes.

Speed: In order to carry out an activity, time is also a fundamental factor. Depending on the situation at hand, it can work for or against us. Therefore, speed and precision are very important.

There are different ways in which speed can affect us. For example, if the object or stimulus is moving, we have to adapt our movements to be able to catch it, dodge it, separate it, etc. It is also possible that the person is moving and the object is still. To work on reflexes, we will have to be the ones to take into account our speed and space in order to be able to solve the task effectively.

Direction, Posture and Stability: The body and the position in which we find ourselves also affects how we will have to respond to the different stimuli and situations that we are going to find ourselves in. For example, it is not the same to have to run a race on smooth ground or on an unstable one. Just as it is not the same to have to start on your knees, move laterally or on your back... Therefore, we will have to perform different exercises to be able to deal with these different situations in case they affect us.

To be able to work on this, there are multiple obstacle courses, activities and games in which we can work in an easy and entertaining way.

3.3 Motor learning

But in order to carry out an activity, we first have to learn and see what is being asked of us to respond to that problem or need. We have to learn and master different strategies to be able to perform and coordinate our movements so that we can perform the action effectively. This is where the idea of motor learning comes in.

In the article Motor control from research to clinical practice Shumway-Cook, (2019) motor learning is "a set of processes associated with practice or experience that implies relatively permanent changes in the ability to produce a competent action".

Something that we must keep in mind is that there is a difference between motor learning and motor control. While motor learning focuses on the student or person learning how to do the task, motor control focuses on executing movements appropriately.

For Fitts and Posner (1967) three stages stand out when it comes to the acquisition of motor learning:

Verbal-cognitive: This is the first stage in which the person speaks or hears about the activity for the first time. That is why he must learn and understand the situation. That is why this phase is usually marked by multiple errors, constant repetitions, constant feedback and control to supervise that the activity is carried out more appropriately. This phase is important because the student has to understand orally or in writing the specifications that he will have to do physically later on.

Associative At this stage, attention to cognitive and verbal aspects is less important. The person focuses more on the perfection of the activities in achieving a greater “refinement”. The progression is usually little by little, but this stage, like the previous ones, depends on each person. They may have more difficulties in the areas of comprehension and interpretation than other people.

Autonomous: We could say that at this stage the person performs the activity automatically almost without thinking or spending a lot of time making decisions and assessing risks. For example, a good way that we can check if it has been acquired autonomously is if he/she can perform another task at the same time.

But beware, not all people reach these levels, they reach different levels, so many times we can find people who get stuck in the verbal or associative phase and never reach that autonomous phase. This in the classroom can be observed when the child is performing a fine motor task such as writing and is not able to follow a cognitive task at the same time, such as taking a dictation that requires listening and writing at the same time, if the child hasn't automated the ability to write he will not be able to retain the words of the dictation subtracting.

3.4 Eye-motor coordination

Before talking about eye-motor coordination, we have to be clear that we require good ocular motor skills. The oculomotor system is a complex system that governs the coordinated movements of the eyes. It allows us to follow up, the vision jumps from one object to another, perception and vision in 3D when the two eyes work in coordination, giving us depth information. In the educational field, it should be taken into account that an inadequate functioning of this system will cause problems such as headaches and dizziness when there is

a greater demand for reading, difficulties in reading acquisition, children who continue reading following their finger because they get lost in the line skipping, children who do not dissociate gaze and body movement and move as a block, problems changing planes of work such as looking at the blackboard and paper, problems with depth and space-form perception. Since teachers are in constant contact with them, we can be the first to detect that the child presents difficulties in this field.

All activities require good coordination between our receiving eyes and our different body segments: arms, legs and other and other parts of our body that are going to carry out the activity. That is why it is important that we have and train good eye-motor coordination. In his article Bender (1969, page 27) defined visuomotor coordination as “the function of the integrated organism, by which it responds to given stimuli as a whole, the response itself being a constellation, a pattern, a gestal”.

Eye-motor coordination helps us to carry out such important tasks for our day-to-day lives such as: driving, running, dodging, throwing, receiving... Also, in the educational field it is very important because it is directly related to reading and writing. Poor eye-motor coordination can give serious problems for the acquisition and learning of these.

Fernández-Marcote (1998) talks about the existence of two types of eye-motor coordination: the “óculo manual y óculo pédica” and Herrera (undated) tells us about what both are and explains the exercises and activities that comprise them.

Oculo-manual or dynamic-manual: will understand the proper use of the hands thanks to the information provided by the eyes. Our eyes receive the necessary sensory information and our hands must be capable of performing the task at hand through precious movements. These activities and games are mainly focused on throwing and/or receiving objects at a certain distance where the person can be moving or static. Also, fine motor skills and precision exercises such as: threading a needle, fitting, following a line, drawing, placing, sorting.... Many of these tasks are largely related to reading and writing.

Oculo-pédica or dynamic-pedal: It is very similar, except that in this case our legs will have to take the information provided by our eyes in order to respond to the task or problem we are faced with. This coordination is important when practising sports such as running, kicking, jumping over obstacles...

3.5 Dyspraxia or developmental coordination disorder

Sometimes in the classroom it can be observed that there are some children who find it more difficult to perform or understand activities than the rest, even if they do not have any detected problem or disability. One of the causes of this may be due to a process called dyspraxia or commonly called "clumsy child syndrome".

According to the Dyspraxia Foundation, dyspraxia is a condition that affects movement and coordination. Dyspraxia is relatively rare because the origin of dyspraxia is not well understood and brain injury or disease is ruled out. Dyspraxia is different in each case as we will discuss later, one conclusion we can draw is that a person with dyspraxia is a person who finds it difficult to perform the simplest everyday activities that we do all the time (tying shoelaces, riding a bicycle, writing...). Therefore, depending on the degree of impairment of the person, they will be more or less able to do it by themselves. It is not a problem that only affects children, but adults can be found with this condition. According to the Dyspraxia Foundation between 5% of children are affected and 2% are severely affected.

Some of the traits that characterize people who suffer from dyspraxia are:

- Delayed acquisition of early motor skills such as sitting, crawling, and walking
- Actions such as running, jumping, catching and throwing are more complicated than other children.
- The movement is clumsy, slow and hesitant.
- The complexity of getting dressed and using cutlery.
- Little understanding of spatial concepts such as above/below/top/front.

Dyspraxia can occur at four levels depending on how it affects the person. For López (2021) there are 4 types of dyspraxia:

- **Ideomotor** in this case the person understands the action or task that is being asked of him, only that he is not able to coordinate his actions and perform the task appropriately. For example, the child is unable to grasp an object. The problem of this is not intellectual, only motor.
- **Ideational**: the person is not able to understand and coordinate his actions to be able to carry out the task that is asked of him, there are motor planning problems. For example, the child is not able to tie his shoelaces correctly because, apart from not understanding the procedure, he suffers from motor problems.
- **Oromotor**: the ability that is affected in this case is that of speech, the child is not able to pronounce certain words or syllables.

- **Constructional:** the person has difficulties to understand the space and the objects that surround them and how to interact with them. People with this problem have problems working with shapes, making copies of images, and organizing themselves in space.

3.6 Problems that pupils may have in class

We may encounter one or more pupils in our class who have difficulties in the areas of motor skills and coordination. These problems can significantly affect students academically and socio-affectively. It is therefore important for teachers to be attentive and to work together with professionals so that each student can be treated individually and adapted to his or her needs.

So based on my experience in the school the main problems I have come to observe in the school are:

- Postural problems
- Concentration problems
- Problems in grasping and controlling objects.
- Problems with handwriting
- Problems understanding and using certain objects
- Problems in controlling and moving around in space
- hand dissociation difficulties
- Difficulties in controlling both sides of the body.
- Problems in differentiating laterality or in differentiating between left and right.
- Difficulty in working at different paces and demands.

3.7 Advantages of good coordination and motor skills

Coordination and motor skills are abilities that bring great advantages and benefits to our daily lives: flexibility, precision, strength, memory, concentration, reaction. They all contribute to physical and emotional well-being and condition the emotional and social development of children as they discover the world around them.

The areas they influence the most are:

- **Health and well-being:** Physical activity improves flexibility, increases muscle strength and precision in movement, preventing future injuries and postural problems as well as reducing the risk of cardiovascular disease.

- **Sporting performance:** Those individuals who have better motor skills than their rivals and peers have an advantage when it comes to performing certain tasks.
- **Self-esteem:** If an individual feels confident and self-assured, his or her self-perception builds an adequate self-image and body schema.
- **Social:** The image an individual projects is important. In order to demonstrate this, let's talk about the halo effect. In psychology, the halo effect is known as the idea that the impression people have of us is due to the way they see us. So because of our posture, our appearance, the way we move, the way we dress, the way we walk.... People build up an idea of what someone is like.
- **Emotional control:** less skilled people make more mistakes, are more easily frustrated and have poorer emotional control. Improving their motor skills has a positive impact on all areas of their lives.

4. Learning through play

Through play we can work on different areas such as the transversality of other skills such as mathematics, language, knowledge of the environment, socio-affective relationships... As well as working on our motor skills and coordination.

We can learn through games what teamwork is and learn to respect our own teammates and rivals. Games tend to generate bonds and friendships between teammates and they also allow us to learn about the different roles that people can have: some are more comfortable making decisions, others being spokespersons, others obeying orders...

We must bear in mind that children play for the pleasure of playing and adults must be clear about the objectives we want to achieve with the playing activities we propose.

For López (2010), playing and toys are very important because for him they determine five personality parameters linked together:

- **Affectivity:** Children have to learn to control their emotions. It is not the same when they are winning as when they are losing, when they are happy as when they are unhappy. These games and toys forge children and make us see their character. So, we get to know them better and they get to know themselves, their strengths and their weaknesses.

Bettelheim in (1987) said the world of play for children is as real and important for them as the world of work is for adults. Therefore, it must be accorded the same dignity.

So, although from the outside it may seem that play is useless, unnecessary and chaotic, it allows children to relate to each other. It allows them to relate to each other, in addition to the fact that by playing they develop and build themselves as people.

- **Motor skills:** when children play, they discover their own bodies. Through games and activities, they explore, learn and acquire sensations and experiences for future situations.

For Marín (2009) play is a fundamental part of childhood and the development of the child, these games work the child's need to look, touch, curiosity, experiment, invent, imagine, learn, express, communicate, create, dream...

Therefore, through play, children discover and explore the world around them. These games help children to build the world and to understand how things work. That is why it is often not understood that children have to spend hours and hours sitting still and listening in the classroom instead of going outside to learn and experiment by themselves.

- **Intelligence:** games make children learn and ask themselves why things happen. We often hear: "*and what happens if I do this or why this doesn't work, what makes the toy move?*". Children discover the world through playing.

The AAP (American Academy of Pediatrics) (2018, page 1) also weighed in on this and spoke in a "Play is not frivolous; it builds the brain".

Thus, learning and practice help children to develop and work on their skills in a practical way. Children should learn through making mistakes, falling down, getting up, laughing and crying.

- **Creativity:** For children any situation or element can be a great opportunity to create an adventure or a game. Those are abilities that when you reach the adult world everyone wants and when you are a child you do not value them.

Abraham Maslow (1960: page 3) quoted as saying "Almost all creativity involves intentional play"

So, when children play, they are creative, they create their own scenarios, adventures, rules and details... Play favours our imagination and gives us a wide range of

possibilities in which we will have to face a multitude of situations and respond creatively.

- **Sociability:** Games are activities in which we learn and share experiences with our friends and classmates. They make us create our group of friends, they mark our personality and our way of seeing the world.

Sanchez (2013) also gives his opinion on the importance of playing in children's relationships and socialisation. He considers that the game, however innocent it may be, reveals equalities and affinities, because when we play with someone there are no borders, no hierarchies, no biographies; the game is a space of all and for all.

4.1 The world of video games

Video games are here to stay. This form of entertainment has undergone an incredible boom since 1958, when Higginbotham created the popular "Tennis for two" for the Brookhaven National Laboratory exhibition. Since then, its progress has been exponential and has not yet reached its peak. Starting from entertainment, they have been integrated as a technological working tool in different professional fields, thanks to their capacity to simulate real flight scenarios, driving, surgical interventions or in the rehabilitation of patients... In the field of education, they are also used as didactic tools due to their playful, dynamic and integrating component, they are a different and entertaining way of learning that allows the acquisition of values and important social skills for the comprehensive development of children.

Even so, we can find people who are reluctant to use them due to lack of knowledge or stereotyped ideas. These people who do not accept video games tend to think that are addictive, encourage violence or generate socialisation problems...

Many studies have been carried out that endorse the benefits of video games as a form of learning. In addition, websites such as Iberdrola's website talk about the benefits that video games can provide:

- **Cognitive development:** facing virtual environments that change according to the decisions made by the player, helps to plan and improve strategies and decision-making methods in a critical and ethical way, as well as stimulating and encouraging creativity and originality.
- **Encourage teamwork:** cooperative video games teach respect and teamwork to achieve common goals.

- **Motivation and interest:** the gradual increase in difficulty in video games means that the player has to work hard to achieve success; it is a personal task and the results depend exclusively on the game skills demonstrated, which encourages self-improvement,
- **Social skills:** video games have changed the way of interpersonal relationships, allowing players to play with other players, working on communication, expression, empathy and teamwork. The introduction of online gaming internationalises relationships including learning other languages and cultures.

4.2 Video game consoles

This new era has generated a wide variety of consoles and video games that allow us to work and enjoy ourselves with them. They encourage users to carry out physical activities and receive instant feedback on their progress and evolution, making this a dynamic and entertaining way of exercising.

Having so many alternatives and possibilities makes it necessary to analyse which video game consoles and games are the most appropriate for the objectives pursued, taking into account personal interests, economic factors, adaptability and difficulty of use...

That is why below I will analyse the most popular and best-selling consoles of today. In them we will see what their advantages and disadvantages will be. For this we will take into account factors such as:

Price, playability, availability, variety of games, accessories among other factors.

Once all of them have been analysed, we will come to the conclusion of which console is the most convenient for us in order to achieve the objectives of this work.

Sony PlayStation (Ps5)

It has many models (PlayStation 1, PlayStation 2, PlayStation 3, PlayStation 4 and PlayStation 5). It is one of the most popular consoles on the market being the most preferred and best-selling in the gamer world.

In its latest model (PlayStation 5) there are multiple games that require great motor skills: FIFA, Just Dance, Spiderman, The last of us, My little planet... Many of these games require concentration and skill to overcome tests of great cognitive requirement.

| Advantages | Disadvantages |
|------------------|---------------|
| Variety of games | High price |

| | |
|--|----------------------------------|
| Very intuitive and interactive | Lack of stock |
| The controller has a high sensitivity so it will allow us to feel the stimuli better (hits, turns, shots, jumps...) | Common errors and system crashes |
| Wide variety of accessories such as steering wheels and modes that allow us to better adapt to different games allowing a very immersive experience | |
| Wireless controls with charging via USB ports to the electrical network | |

Xbox Microsoft

Along with PlayStation, it is considered one of the biggest brands of video game consoles. It has four generations (Xbox, Xbox 360, Xbox One, Xbox Series X|S.) Its latest model Xbox Series X|S, like PlayStation, has a huge variety of games. Some examples such as Dance Hero and Guitar Revolution allow you to work on coordination and body movement as well as rhythm and timing.

| Advantages | Disadvantages |
|--|--|
| Variety of games | High price |
| Very intuitive and interactive | Low resolution compared to competition |
| It is the most powerful console on the market | Size is one of the largest consoles that exist and can be very heavy (4.5KG) |
| Accessories such as steering wheels and modes that allow us to better adapt to different games allowing a very immersive experience | Complex menus and interface |

Wii

Wii was developed by Nintendo on 19 November 2006. Its controllers are complex, using complex motion controllers such as gyroscopes, accelerometers that translate the player's actual movements with the controller into different game actions on the screen.

It allows to create and customise different avatars giving similar appearances to the player, it allows to introduce characters of family and friends and compete individually, between them or team up and beat other rivals that the console presents.

One of its most popular games is Wii fit, which introduces balance work and allows you to monitor your progress thanks to the balance board accessory.

| Advantages | Disadvantages |
|--|--|
| Variety of games | The large number of cheats can discourage players. |
| Affordable Price | Reduced storage |
| Games that promote coordination, motor skills and fitness. | Number of video games very limited. |
| Possibility to customize our avatar and feel part of each game. | Sensors and controller calibration may fail. |
| Accessories such as mats that allow us to monitor the races, jumps, supports on one foot, dances... | Many accessories are wired, which makes them cumbersome, or they have batteries, such as battery-powered remote controls, which means that their maintenance cost is high. |

Virtual reality video games

Several video games consoles such as the Oculus quest have already dared to launch this type of video games. Their value in terms of experience and enjoyment is undeniable due to the player's immersion in the virtual environment. Negative factors include the difficulty of finding one's way around the game, the heaviness and discomfort of the glasses and controllers for children and their cost.

| Advantages | Disadvantages |
|---------------------------------------|-------------------------------|
| Very realistic | High price |
| Very intuitive and interactive | Lots of expensive accessories |
| Very Dynamic | Awkward controls and glasses |

Cheap alternatives

As a cheap alternative for people who can't afford any of the above is Ouya. It is an entertainment system that was launched in 2013 by Uhrman. The developer tries to bring current game consoles to users at an affordable price by allowing them to download games from Android, so users can access a wide variety of games.

| Advantages | Disadvantages |
|------------|---------------|
|------------|---------------|

| | |
|-------------------------------|---|
| Low cost | The quality of the games can leave a lot to be desired. |
| Great variety of games | There are no updates |

Nintendo Switch

Nowadays there are plenty of consoles available that allow for great immersive experiences. Games are becoming more and more elaborate, allowing players greater freedom, reality and playability. At the same time as the options and possibilities are increasing, the prices of these devices are tending to rise. Therefore, it is necessary to find a game console that not only offers great performance but also an affordable price.

Nintendo Switch was released in 2017. With this game console Nintendo manages to give a more realistic and intuitive experience compared to its previous models. The features it offers in comparison to its competition are truly incredible:

| Advantages | Disadvantages |
|--|---|
| Low cost | Storage capacity: only 32 GB |
| There is a wide variety of games for people of different ages and tastes to enjoy. | Low resolution in portable mode |
| Versatility (It has different game modes and can be played from the TV, in portable mode and in desktop mode.) | Its battery life is less than the Nintendo 3DS with a battery life of 2.5 to 6 hours. |
| Mobility (many of the games require the user to move, scroll or co-ordinate their movements. Not all consoles do this, as others do not require the player to move but instead require them to be seated and spend many hours in front of the screen in a fixed position) | |
| Quality (its materials are of high quality and it has a tempered glass screen that makes it resistant to knocks and scratches) | |

For all these reasons, by analysing and researching the different consoles, the Nintendo Switch has been chosen as the game console to be studied in this dissertation

5. **The study**

Nintendo Switch has a wide variety of games of different categories and genres designed for a wide range of audiences: role-playing games, games of chance, games of physical skill, strength, memory...

In this study, the aim of using video games is to improve the motor skills and coordination of children who have more difficulties, so the Nintendo Switch Sports and Just Dance games are chosen as a study model.

So, I will analyse and observe the capabilities that framework have been defined. during the theoretical part. The best way in which this research can be done is through practice to observe by myself how the games feel to work on, I have used the game console and played the games. In order to get to know the different characteristics of each I have created a table marking which capacities are worked and which are not during each game and later I have developed in a more extensive way how each of these are worked in that way in the video game.

5.1 Nintendo Switch Sports

Nintendo Switch Sports was launched on 29 April 2022. This line has been developing and improving the gaming experience from the first Wii consoles to this latest version. The aim of these mini-games is to provide an immersive way to play sports with family and friends or to play with online rivals by facing off in real time against people from other parts of the world to see who is the champion.

The sports offered by the game are very popular: volleyball, football, tennis, badminton, golf, sword fighting and bowling. Most of the public is familiar with them, knows how they are played and their rules, so it is easy for the player to follow. The controllers used are the Joy-con which are small and light and very handy and the leg belt accessory for the football game. In this paper we are going to focus on the classic mode, which is played in the same room with family and friends.







5.1.1 Nintendo Sports Volleyball

In this game mode you can play against each other or team up against the game console. You can also play 2vs2. At the start of the game, you choose which hand is holding the left or right controller. The game consists of playing a game of volleyball in pairs with the movements of serving, receiving, setting, spiking and blocking. Each of these actions requires a specific arm and/or hand movement that the player must perform in an appropriate order and time with the help of the joy-con controller.



| Volleyball | |
|------------------------------|---|
| Hand-eye coordination | ✓ |
| Foot-eye coordination | ✗ |
| Fine motor skills | ✓ |

| | |
|---------------------------|---|
| Gross motor skills |  |
| Timing |  |
| Motor planning |  |
| Spatial awareness |  |

Hand-eye coordination: the player's hands and fingers must be placed in the precise position to be able to perform the different movements. This game has 5 strokes: serve, reception, placement, smash and block. The movements requested in the animations must be imitated in order to perform the actions correctly to hit the ball that is approaching the avatar.

Foot-eye: in this game, no work is done.

Fine motor skills: the movement and control of the character or avatar around the court is done with the joystick of the controller to position him/her to receive and block, which requires the dissociation of the thumb.

Gross motor skills: the entire upper body is worked on, especially the shoulders. It stimulates bimanual coordination, requiring both arms to work in coordination in order to achieve good spikes, blocks, serves and receptions. It also stimulates the dissociation of the two arms in activities such as the serve where each limb performs a specific and different action.

Timing: the rhythm of the game depends on precision. If they are too early or too late, the actions will be uncoordinated and imprecise, leading to the player's defeat.

Motor planning: a strategy must be used when playing, which stroke to use for blocking or receiving, positioning the avatar properly in the game space, using more or less force or speed in the strokes... This game is a sequencing of movements: first you serve, then there are three steps that are always repeated, reception, placement and smash (blocking can only be used if you act quickly), so the player has to remember the order of execution of the movements to avoid failing and scoring a point.

Spatial awareness: the character must be properly positioned in the playing space and moved in order to achieve the best blocking or smashing position. Also analyse the opponent's movements (see their movements, where they are hitting from) in order to use it to their advantage.

5.1.2 Bowling

In this game mode we will have the experience of living a bowling game in a very realistic way. There are two game modes, a classic mode and a special mode in which you have to avoid different obstacles and knock down as many pins as possible.

Only the joy-con controller is used, before starting you choose which hand uses the controller, this game requires not only that the controller moves in space when bowling but also that the bowling positions are decided with the buttons.



| Bowling | |
|-----------------------|---|
| Hand-eye coordination | ✓ |
| Foot-eye coordination | ✗ |
| Fine motor skills | ✓ |
| Gross motor skills | ✓ |
| Timing | ✓ |
| Motor planning | ✓ |
| Spatial awareness | ✓ |

Hand-eye coordination: the ball must be thrown correctly so that the throw knocks down as many pins as possible. In addition to getting into position and giving the spin and force necessary to knock down as many pins as possible. So, eye and hand must work in unison.

Foot-eye: in this game, no work is done.

Fine motor skills: the joystick must be moved so that the character reaches the best position for the throw. We work especially on the dissociation of the thumb because this is the one that will guide our character.

Gross motor skills: the whole upper part of the body is worked on. In order to perform the throw correctly, a sequencing and imitation of the movement must be followed so that the throw is as precise and accurate as possible.

Timing: this is very important because if we throw when we have the ball behind us our shot will not come out. Also, if we throw too fast, our shot may be deflected or inaccurate, so we will have to take the timing into account when we make our shot. Also, in the special mode, when we have to dodge different barriers, we will have to take into account the strength, speed and obstacles.

Motor planning: you have to take into account what strength, precision and spin you have to use for each throw. This can be seen very well in the special mode. Because when encountering different barriers, different strategies have to be applied to overcome the different elements.








Spatial awareness: in addition to being aware of where the pins are located, the avatar must also be taken into account. So, you have to pay attention to the space and make the required throw for the circumstance at hand.

5.1.3Badminton

This game mode is for one or two players. You have to beat your opponent in a game of badminton. The first to reach 5 points with a difference of 2 points wins.

You choose the hand that holds the joy-con and the actions of the game are serve, forehand and backhand. When you press the ZR button on the controller, the player makes a drop shot.



| Badminton | |
|------------------------------|---|
| Hand-eye coordination |  |
| Foot-eye coordination |  |
| Fine motor skills |  |
| Gross motor skills |  |
| Timing |  |
| Motor planning |  |
| Spatial awareness |  |

Hand-eye coordination: This game is one of the simplest Nintendo Switch Sports games. During the game you have to coordinate your arm and respond to the approaching ball. You have to be precise, as an early hit will be less effective and will give your opponents an advantage.

Foot-eye: in this game, no work is done.

Fine motor skills: although basically the upper body is worked on. There is one movement, the drop shot, which is made by pressing the ZR button. It can be seen that this game is one of the simplest in this video game.

Gross motor skills: works the upper limbs. During the game you have to think and coordinate your movements. In the game there are four strokes: serve, backhand, forehand and

smash. It will depend on the placement of the hand which strokes are going to be made. This game could be very useful to work with people who only use one hand.

Timing: the game depends on the rhythm of the game. Because a hit on time or at the wrong time can give an advantage to the opponent.






Motor planning: we must plan and modify our game depending on the different circumstances in which we find ourselves. We can play more aggressively or more conservatively. We can also play more tactically and move our opponent around the court. The possibilities are wide and varied.



Spatial awareness: it is important not only to know where our character is, but also where our opponent is. This conception will allow us to have numerous strategies and we will be the ones who will have to decide which is the most appropriate for each moment.

5.1.4 Chambara

This game can be played by one or two people. The game consists of trying to knock the opponent off the platform before the time runs out. The characters use a thick sword that hits without hurting but rather displacing the opponent until he falls off the platform into the water.



| Chambara | |
|------------------------------|---|
| Hand-eye coordination |  |
| Foot-eye coordination |  |
| Fine motor skills |  |
| Gross motor skills |  |
| Timing |  |

| | |
|--------------------------|---|
| Motor planning |  |
| Spatial awareness |  |

Hand-eye coordination: It is important to observe both the sword we carry and the opponent's sword. We must be able to strike an appropriate blow when the opponent's guard is down or is poorly positioned and respond to the opponent's blows with adequate defence and precision. Therefore, you must pay attention to your opponent's hands and co-ordinate your arms to be able to overcome his guard with an accurate strike.

Foot-eye: in this game, no work is done.

Gross motor skills: the positioning of the hands and arms is very important in this game. An inappropriate stance will present a poor defence which will give you a significant advantage. In addition, the strikes must be quick and accurate so that the opponent does not expect them.

Fine motor skills: to defend you have to press the Zr button and place your hands in the right position to block the opponent's blow. In this game we work on the placement and positioning of the hands, as well as the different strokes.

Timing: this depends a lot on the players. Two people who know each other and play more calmly are not the same as two who have never played before and their strokes are not precise. Timing must be well measured because an unfortunate stroke can lead to the opponent taking the lead and breaking the dynamic of the game and achieving victory.

Motor planning: you have to analyse the different situations that arise during the game. You can play aggressively or more passively and wait for the right moment. It is also important to know how to modify your gameplay according to the opponent you have to face.

Spatial conception: it is not important to know and discern how to play when there is a danger of falling and losing the game or when there is a clear situation to take down the opponent. Space therefore determines the way in which the game is to be played. Depending on the area in which the character is located, we will choose one option or the other.

5.1.5 Football

The possibility of playing with one or two players, choosing between one-on-one, 4 vs. 4, training or duel. The game consists of scoring more goals than your opponent in two minutes.

It requires the use of 2 joy-con, one with each hand. The B button is used for jumping and the ZL for running, and the joy stick for moving in space. The various ball strikes are performed with specific movements of the controllers.



| Football | |
|-------------------------------|---|
| Hand-eye coordination: |  |
| Foot-eye coordination |  |
| Fine motor skills |  |
| Gross motor skills |  |
| Timing |  |
| Motor planning |  |
| Spatial awareness |  |

Hand-eye coordination: you have to be able to respond to the approaching ball and give a response. In addition to the fact that this game has a wide use of fingers and hands requiring a good understanding. In order to be able to solve the needs that arise throughout the game.

Foot-eye coordination: there is the possibility of putting one of the joy-con on the leg and thanks to this. It is possible to make shots thanks to this gadget, so it is possible to work on precision, placement and power.

Fine motor skills: manual dexterity will be key to this game because the character is guided towards the goal by means of the joysticks. In addition, actions such as jumping require pressing the b button and sprinting with the ZR button. Accuracy is important because without

it the character will be out of control, tired and disoriented. Therefore, a good dissociation of the fingers, especially the thumbs, is required.

Gross motor skills: the movements of the arms will have different functions. From the bottom to the top, we will perform a high shot. From top to bottom a low throw. By moving the right arm to the right, a shot to the right, and by moving the arm to the left, a shot to the left. This function can be performed with the leg if the joy-con is placed on the leg.

Timing: you have to be precise when hitting the ball and stop it when your opponent is the one taking the shot. It is also important to control the timing of the match and adapt your responses to the match situation. It should be taken into account that the speed of the ball depends on the power of the shot. In addition to the fact that this game is timed so the game and aggressiveness at the beginning and at the end of the game will not be the same.

Spatial awareness: it is important to make an analysis of the court and to be able to see what advantages can be taken from it. It is important to observe the position of the opponent and your own position and how to take advantage of the elements to get the best out of them.

Motor planning: different strategies must be carried out in order to be able to beat our opponent. Therefore, the gameplay must be adapted to the situation of the match. In addition, we will have to develop different strategies to be able to beat our opponent. The shots and the possibilities offered by this game are very high which allows people to develop different styles and that all can be effective.

5.1.6 Golf

This game can be played by one to four people. It has an infinite number of circuits to participate in. The number of holes to be played is decided before each game: 3, 9 or 18. A joy-con control is used, which is held with both hands, simulating the grip of a golf club. The body is positioned laterally, copying the real action of the golf shot. You can choose the type of club, the trajectory of the shot and the spin of the ball using the buttons on the controller. The distance the ball travels is determined by the force of the stroke, as well as the direction of the ball. The game introduces variables such as the strength and direction of the wind which affect the trajectory and path of the ball, the environment is realistic, there are sand bunkers where the ball slows down, trees, cliffs, water areas that make the ball get lost... in short, all the obstacles that a real golf course presents.



| Golf | |
|------------------------------|---|
| Hand-eye coordination |  |
| Foot-eye coordination |  |
| Fine motor skills |  |
| Gross motor skills |  |
| Timing |  |
| Motor planning |  |
| Spatial awareness |  |

Hand-eye coordination: requires good precision in order to be able to print the most appropriate stroke for each throw.

Foot-eye coordination: although as such there is nothing to mark and analyse the position of the body, a good posture helps the shot. By imitating the steps and positioning of the avatar, we will be able to make the shots much more precise. Therefore, the positioning of the body and lower limbs will be important.

Fine motor skills: with the joysticks you can choose the direction of the ball and with the surrounding buttons you can choose the club to be used to hit the ball. So you will have to choose it according to the need that is required in each circumstance. It is also necessary to aim at the ball in order to hit it.

Gross motor skills: good posture and coordination of movements are important for a good stroke. If this is not achieved, the shot will be defective or will come out crooked. If the avatar's posture and gestures are imitated, the shots will be more accurate.

Timing: although it is not as noticeable as in other sports, it is also important. If we release the stick too early, the shot will not work.






Spatial awareness: in this game you can find lakes, trees, sand bunkers and many other obstacles. Therefore, the shots must take these factors into account. The wind will also be an element that, although invisible, will affect the shots in a big way, so it must be taken into account.



Motor planning: you have to know how to analyse and interpret the different situations. Because an excessively strong, short or curved shot can determine the game. In addition, the choice of clubs is important thanks to the great variety that exists and can be adjusted to the needs of the game and the player.

5.1.7 Tennis

This game can be played with up to four players. In pairs mode or play against the console or be part of the latter. The match can be a single game best of three or best of five games. In this mini-game you will use a joy con controller. Previously you will choose which hand will be in charge of the shots. This sport has three main strokes: serve, backhand and forehand.



| Tennis | |
|------------------------------|---|
| Hand-eye coordination |  |
| Foot-eye coordination |  |
| Fine motor skills |  |
| Gross motor skills |  |
| Timing |  |

| | |
|--------------------------|---|
| Motor planning |  |
| Spatial awareness |  |

Hand-eye coordination: this game requires good hand-eye coordination to be able to respond appropriately to an approaching ball.

Foot-eye: in this game, no work is done.

Gross motor skills: this game requires several strokes: serve, backhand and forehand. It is not extremely complex because during the game there is no need to press buttons or make turns with the joystick. Just hit the ball as it approaches the character.

Timing: it is important to respond to the ball when it approaches. But you don't get any prize penalties for being late, it's more of a ml hit.

Motor planning: you have to know how to move your opponents around the course in order to get a gap and win the point. That is why it is important to know and choose correctly which stroke to use in each situation.

Spatial awareness: it is important to know where your character and your opponent's character are. To act accordingly. It is not the same if you are near the net, at the end of the court, at the end of the court, or off-court... Therefore, depending on the area in which the avatar is located, you will have to make the appropriate decisions.

5.2 Just dance

This is a classic game that for years has been one of the most played games and nowadays it is still one of the most played games because of its songs and its great choreographies. This game still has its place in the new consoles so we can see that it still has a great reach, even though the years go by.

The game consists of choosing a song and choreography and following the steps that the avatars stage on the screen. For this game a joy-con controller is used that will move at the same time and rhythm as the character moves that arm.



| Just Dance | |
|-----------------------|---|
| Hand-eye coordination | ✓ |
| Foot-eye coordination | ✓ |
| Fine motor skills | ✓ |
| Gross motor skills | ✓ |
| Timing | ✓ |
| Motor planning | ✓ |
| Spatial awareness | ✓ |

Hand-eye coordination: in this game you have to follow the movements that are marked on the screen to the rhythm of the music. So you have to coordinate the movements in time and space and repeat them as they appear on the screen. Poor coordination will lower the score.

Foot-eye coordination: Choreographies often require spins, jumps and acrobatics. But there is nothing to track the movements of the feet, which is one of the most notable shortcomings of this video game.

Fine motor skills: it won't be as much about touching buttons as in the previous games but more about hand positioning. Spinning, twisting, clapping, clicking...

Gross motor skills: these involve large muscle groups. From the arms to the feet. Choreographies usually require a great understanding between our upper and lower body.

Timing: it is very important because doing a movement before or after can lead to a big difference in points. So, you have to try to match the movements perfectly in the time and space required.

Motor planning: you also have to take into account when dancing the next movement to be performed, so you have to be attentive to the screen and be ready to perform it.

Spatial awareness: you need to know how to orientate yourself in space in order to be able to perform the movements properly. It is important to take into account whether we are alone or accompanied to avoid possible injuries or aggressions with the people we share space with. In addition to falls or blows, which are quite common when a person plays this video game.

5.3 Results of the study

Analysing the different video games, we can observe that all are extraordinary tools to work on motor skills and coordination because they work on a wide range of skills.

Each of the video games has different levels of difficulty which allows us to adapt to the characteristics of the child depending on how or what we want them to work on. A strong point of this style of work is that it can be done at home and in an environment that allows children to feel comfortable and safe.

This type of games awakens children's interest and curiosity towards sport. Because they allow them to feel and practice sports that in normal occasions would be difficult to practise.

The animations are very useful because thanks to them we can imitate the characters and learn; postures, gestures, turns, blows... Although the movements are not exactly the same, they usually reward the player. For example, in the game Just Dance you are congratulated according to the precision of your dance steps.

A characteristic to emphasize of these is that they provide instant and impartial feedback so that the student depends on himself to be able to achieve the different objectives and prizes in each of the levels. It is also possible to observe our progress from the first days to the current moment in which the student is. We can set goals and objectives to achieve that will allow us to achieve extra motivation.

6. Conclusions

During this work I have tried to find more dynamic and entertaining alternatives for children to work on motor skills and coordination through video games. As these activities are carried out at home, families can be involved by encouraging them to play with them, thus showing them their child's strengths and weaknesses and making them aware of the child's motor difficulties and abilities.

I believe that the use of video games is an interesting tool with an exponential growth that has changed the way we live and relate to each other in the last few decades. So, we have two

options: we can adapt and make the most of them or we can stay on the side-lines and not take advantage of them. Given that nowadays children spend a lot of their free time using and sometimes abusing video games, replacing the more passive and aggressive video games with these movement games, which are designed for work, hooks the child into a beneficial activity. Although there are a multitude of video game consoles, I have analysed several and I have realised that for the needs and situations that this work requires, the most optimal console is the Nintendo Switch. The games Nintendo Switch Sports and Just Dance are a very useful and successful tool to work on fine motor skills, gross motor skills, hand-eye coordination, eye-hand coordination, eye-foot coordination.... We can also use accessories such as ring fit which, although useful, require an additional cost and a more complicated handling and have therefore been discarded for this work.

It is also necessary to take into account and observe what type of games are going to be used for each case. Each child is different and it is the task of the teacher to get to know them well, detect their needs and evaluate what is correct and most effective in order to achieve the objectives set. In this case, it is necessary to choose the type of game, duration, modality, degree of difficulty, the pupil's capacity for success, etc.

These video games also bring children closer to an experience that often in real life they could not achieve due to their motor difficulties, which increases their frustration, their refusal to try new tasks and undermines their confidence in their possibilities. By being able to regulate the degree of difficulty with the games, they make the games more accessible to children with greater difficulties, the games are so accessible that they allow them to win games, which increases their confidence and security, stimulating their desire to continue and to put them into practice in real life. The ability to create an avatar with physical characteristics similar to the child's allows the child to feel immersed in the game, giving them a greater sense of reality, as the avatar is more coordinated and is able to pick up a ball, a racket or hit a ball, which will improve their motor imagery. In addition, these games allow the child to record their progress and advancement, the child can see how they have overcome barriers and obstacles and the teacher can quantify their evolution.

With this work I have tried to make the most of the use of video games as a positive tool that has an impact on the motor improvement of the child.

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