The Foundation of the SEE BEYOND Method: Fashion Design and Neuroeducation Applied to the Teaching of the Project Methodology to Students with Congenital and Acquired Blindness

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Abstract. The SEE BEYOND teaching method is designed to include people with visual impairment in higher education fashion-design courses. This method employs a wide range of teaching material that is commonly used in Brazilian higher education institutions. Neuroscience is regarded as a field of knowledge that is essential for creating instruments and carrying out activities aimed at the sensory-motor stimulation of students, whether blind or with normal sight, and encourage them to be involved in the teaching methodology of the Fashion Design project. This article addresses the first of the three modules that structure the SEE BEYOND method: Foundation. The undertaking is combined with the following neuroscientific concepts: Identification, Abstraction, Appropriation and Consolidation. It examines the various ways the module can assist students with congenital and acquired blindness, particularly with regard to the following: (a) the recognition of contours and surfaces; (b) spatial perception based on the relation between two-dimensional and three-dimensional planes; (c) the creative process; (d) the links between the mould and garment; (e) the consolidation of skills; (f) and the exercise of self-criticism.

Keywords: Visual impairment · Fashion design · Neuroscience · Education · Project methodology

1 Introduction

The lack of research studies into the needs of students with visual impairments, or in more specific terms, in higher education Fashion Design courses, has led to the conception and development of the SEE BEYOND method which incorporates this sector in its training sessions. The title of this method consists of an acronym that forms the phoneme SEE, which is made up of the words Stimulate, Educate and Enlarge, which is then attached to the preposition BEYOND. Broadening the range of stimuli experienced by students with or without visual impairments, empowers the teaching/learning process and heightens our awareness of the features needed for compiling collections in fashion design.

N. Streitz and P. Markopoulos (Eds.): DAPI 2017, LNCS 10291, pp. 528–546, 2017.
DOI: 10.1007/978-3-319-58697-7_40

Students with a lack of vision are supported by other sensory directions which can assist them in assimilating and making use of the content provided to achieve the pedagogical aims set out in a higher education training course. In this way, by following the stages of the SEE BEYOND method, touch, smell, hearing, taste and balance, can play a special role that very often goes unnoticed by people with normal sight.

On the basis of these assumptions, the SEE BEYOND method employs a wide range of teaching materials that are commonly adopted in Brazilian higher education institutions. In other words, it recognizes the value of creating and applying instruments and activities that are aimed at the sensory motor stimulation of students, both blind and with normal sight, and for teaching a methodology that can be employed for fashion design. This involves being structured into three modules: (A) Foundation; (B) Enhancement; (C) Materialization. In the sphere of (A) Foundation, the aim is to show the basis of knowledge about design and fashion so that it can serve as a theoretical framework for undertaking projects. With regard to (B) – Enhancement - it is devoted to teaching all the stages related to carrying out projects in fashion design. On the question of (C) – Materialization - all the knowledge acquired in the two previous phases is drawn on and applied to a project that involves forming a fashion collection.

The SEE BEYOND method regards Neuroscience as an essential field of knowledge for pedagogical and andragogical planning - "The brain is the organ of learning" (1). This is taken as a point of departure for this research study where an attempt is made to confront and overcome the obstacles raised by people with visual impairment and find ways of producing new kinds of knowledge. Discoveries in recent years about the development of the human brain, (largely brought about by examinations made through images), have allowed an understanding of a range of cerebral processes, including those linked to questions of learning, memory training and the consolidation of knowledge.

There has been an expansion of studies in the field of Neuroscience [2–12] and Neuroeducation [1, 13–15] which has allowed significant advances to be made in the area of education. This link between Neuroscience and Education is still being forged and has led to in-depth studies, particularly in this century. However, it is rooted in the studies of Luria [16] and Vygotsky [17], early in the 20th century who investigated the reactions and behavior of people with regard to learning as a means of creating knowledge and also belonging to their environment. This article is particularly concerned with the stages in which the module for Foundation (in the SEE BEYOND method) is structured and how it is expressed in neuroscientific concepts: Identification, Abstraction, Appropriation and Consolidation [18–24]. It seeks to ensure that the lesson content taught in fashion design to students with visual impairment or normal sight, can be understood, and assimilated, and thus exist as a memory that can be evoked in the two subsequent modules. This is achieved by employing teaching material that is especially prepared so that it can be made available to people with visual impairment while at the same time serving as teaching/learning resources for students with normal sight.

The Foundation module has a teaching schedule of 24 h and is structured in twelve face-to-face weekly sessions. It is supplemented by a chance to establish communication through other means, such as discussion groups in social network, and e-mails, as well as being able to carry out practical activities outside school that can lead to other kinds of knowledge being produced.

The feelings of touch and hearing are constantly being sought for this, either at the same time or alternately, when planning the features involved in the work [shape, silhouette, color, tissues, frameworks, modelling, trimming, finishing and improvements] [19, 25]; and as well as this, deciding how they should be linked in a chronological order. Fashion, defined as a system [26], is cyclical. Chronological order governs the principles of dressing which reflect society [27], as well as economic and technological change [28–31], and hence have an impact on Fashion Design.

It is hoped that both blind students and those with normal sight can retain this information through the mediation of sensory-motor stimuli and after this, process the mental images. "The mapped patterns constitute what we, conscious creatures, know as visions, sounds, tactile sensations, smells, tastes, pain, pleasure and things of this kind – in short, images. The images in our minds are the momentaneous maps that the brain creates from everything inside or outside of our body, whether concrete or abstract images, in progress or previously engraved in our memory" [4]. In other words, they enhance what has been learnt on the basis of mental maps that are present in individuals and upgraded in real time with regard to the surrounding environment [23] and have associations with their memories. In the sections that follow, the connections are made clear between the different phases of the module that forms the Foundation of the SEE BEYOND method and its neuroscientific concepts of Identification, Abstraction, Appropriation and Consolidation.

2 Identification

Each meaning has its sensory portal and the capacity of the individual to identify an object or environment originates "from the group of regions of the body around which the perception emerges" [5].

This interactive process between the environment and the body, which is directly linked to the brain, is detected by the sense organs or "sensory portals" [5]. In other words, (…) in the case of vision, the sensory portal includes not only the ocular musculature through which we move our eyes, but also the whole apparatus used to focus on an object. This includes the mechanism used to focus on an object by adjusting the size of the lens, the mechanism for adjusting the luminous intensity which dilates or enlarges the pupils (the shutters of the cameras of our eyes) and finally, the muscles around the eyes, by means of which we frown, blink or register delight. (…) Seeing does not just consist of obtaining an appropriate luminous pattern in the retina [5].

Understanding the sensory portals gives a broader idea of how to prepare the resources that are needed to establish the SEE BEYOND method. The study of the sensory portals of touch and sight are essential to achieve this end, as well as taste, smell, and spatial balance, which are all connected to the somatosensitive cortices [5].

All the information that originates from these portals has an intermediary station in the thalamus which leads on to the cerebral cortex where relations are established with the following: sensitivity, driveability, emotional behavior, memory and the activation of the cortex [5, 17].

When creating and planning the program content of the Foundation module, it was believed to be a limitation in the case of blind students and it was thus necessary to provide the resources that could make it possible for them to identify the objects they were given and make a connection between the objects and program content employed for each session of the module. For example, when there was a need to identify the silhouette and the contours of the human body, an articulated doll made of wood that was often used in design classes, was given to the blind students as a reference-point for the human figure. Following this, a board was used that reproduces the same articulation points that are found in a wooden doll. This was fitted with a cotton string on a two-dimensional surface, in a way that could allow a tactile reading of a three-dimensional object. This strategy achieves the purpose of offering a person with visual impairment two ways of representing the human figure, that is two-dimensional (the board) and three-dimensional (the doll). Thus relations can be established between two objects and the figure can be identified (Fig. 1).

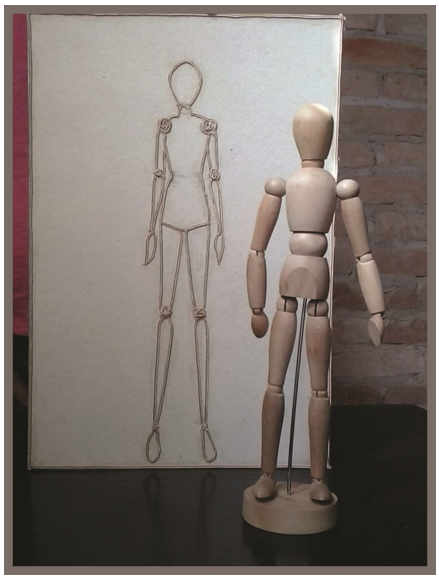

Fig. 1. Tactile board and doll, articulated in wood.

On this basis, the prospect of being able to represent the body in tactile boards is broadened to include representations of the dressed body so that items of clothing on the body and their distinct movements can be highlighted, as well as what they add to the history of fashion (Fig. 2).

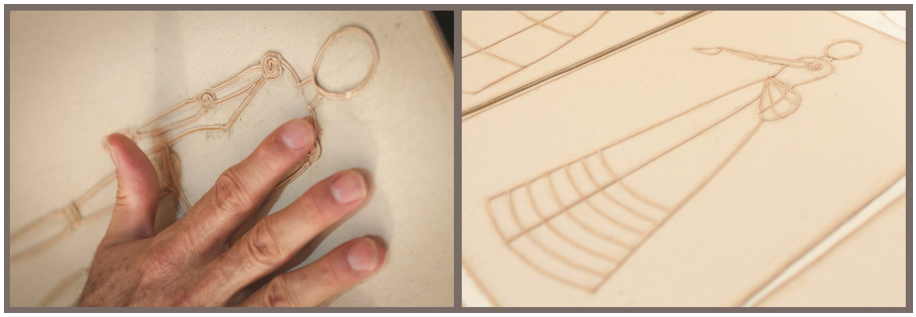

Fig. 2. Tactile boards.

Metal mini sculptures were also created on the basis of the articulated wooden doll and these – in parallel with the embossed designs – made it easier to identify the represented object and perhaps understand the spatial relationship provided by the area bordering each of them. That is, it was possible to locate the inside and outside of the mini sculptures and their relation with the body of the wooden doll (Fig. 3).

Fig. 3. Tactile board and mini sculpture.

In all the teaching material used in the SEE BEYOND method, it is understood that the recognition of the properties of the objects can occur by means of other sensory channels (touch, hearing, and taste which can be directly connected to odour through the identification of smells), as was the case found with people with visual impairment. However, in this stage of the Foundation module, touch is valued and becomes the sensory meaning that can most recognize these materials and their relations with the

environment. In the opinion of Damásio [4], the preparation of the surrounding space is based on the ability of the individual to interact with it and with all the objects present there, through the mapping carried out by the brain. In the use of the word 'object', as described by this author, it is possible that a chair, the sea or wind can be designated as objects which in some way undergo an interaction with the brain; or the object can even be made unique for the individual in the way it is arranged and spread to different parts of the brain. Although there are distinct cortical regions that have special features that respond to particular stimuli, there is a process involving the interconnecting areas that form the cerebral. This is because (…) all the perceptive and cognitive tasks (such as the recognition of objects, decoding and recovery of memory, reading, memory of work, attention processing, motor planning and awareness), are the result of the distribution of large-scale cerebral network [2].

3 Abstraction and Appropriation

With regard to learning, different procedures are carried out by the human brain throughout the period of its life. The concept of Identification, outlined in the previous section, can be included as one of them. Abstraction and Appropriation are others that are also related since they are experienced by the individual when in contact with objects in his surroundings. Although they are different, they are interwoven and for this reason, are included here together.

It is by means of the brain that the individual assimilates, thinks, understands and acts. The brain intervenes in the meanings and (depending on how it perceives the outside world), controls its activities and human behavior. Every kind of acquired knowledge constitutes cerebral activities [5], and before it can form memories, the brain must enter into contact with the environment and with the objects that form it, whether a landscape seen from a distance or something much nearer that it is possible to touch.

In one way or another, the brain processes this information in accordance with the constancy and abstraction that establish close relations with vision and the other sensory meanings. Constancy is designed "to seek knowledge of the constant and essential properties of objects and surfaces, when the information obtained, changes from moment to moment" [15].

A correlation between constancy and abstraction is necessary for the development and subsequent application of accessible resources in the realm of the SEE BEYOND method. As illustrated in the image below, by employing the plain mould, (which is shaped by the students) and with the aid of the articulated dolls, it is possible to create huge numbers of skirts that correspond to different historical periods. The handling of material and draping these on articulated dolls, invokes the concepts of abstraction, assimilation and appropriation. The dimensions of each of the moulds can be recognized by the differences between them when they are superimposed and at the same time, this stimulates the students and provides them with a capacity for abstraction and appropriation. The handling allows the students with visual impairment to make adjustments to the bodies of the articulated dolls and produce different volumes; as a result, this can provide a greater scope for abstraction among the possible shapes of this object.

Thus the process of abstraction begins to be a natural practice in this process which is pervaded by activities involving the identification and abstraction of the objects [19] (Fig. 4).

Fig. 4. Abstraction and Appropriation: a study involving two-dimensional and three-dimensional forms.

In addition, in the choice of prime materials employed for building teaching material, the same features are kept for each type of resource needed; this is a strategy adopted to preserve the concept of constancy.

With regard to abstraction, Zeki [21] states that this is "a critical step in the efficient acquisition of knowledge; without it, the brain would be enslaved to the particular. The capacity to abstract is also probably imposed on the brain by the limitations of its memory system, because it does away with the need to recall every detail."

The concept of abstraction can also be defined in other ways. Nee et al. [22] believe that there are different levels of abstraction which in turn are processed or detected in different areas of the prefrontal cortex. According to these authors, "abstraction refers to the degree to which processing/representation is tied to or divorced from particular instances" [22]. With regard to the kind of operation involved in abstraction, they put forward two theories – temporal and relational – each with its own operations and distinct responses to the stimuli received by the brain. In these cases, the kind of processing is tied to determined kinds of thoughts and intentions.

According to Nee et al. [22], temporal abstraction adopts the notion that the more abstract the objectives are (for example, "buying a car"), the longer will be the periods of responses related to the control of more concrete sub-objectives (for example, "going to the dealership", "having a test drive", etc.).

When employing the SEE BEYOND method, the concept of temporal abstraction can be applied when the objective is (i) how to make a *look* (Foundation) or a fashion collection (Materialization), both characterized as a more abstract objective, followed by; (ii) their respective sub-objectives (designing a model for an item of clothing; defining the textile materials; and completing the manufactured product).

The temporal differs from relational abstraction in so far as with regard to the latter, "the stimuli formed a pattern with one or more dimensions (e.g. shape, orientation, size) changing in an orderly manner across rows and down columns of the matrix" [22] (Fig. 5).

Fig. 5. Abstraction: (a) Design of the model; (b) definition of the textile materials; (c) preparation of the moulds; (d) manufacture.

In the sphere of the Foundation module, the concept of relational abstraction remains clear throughout the stages that follow the construction of the mould for the item of clothing and by working on the planned features (points, lines, shape and volume).

Points and lines are related to the measurements of the body. The relationship of shape x volume is established in a way that cam allow the students to have a clear idea of the correspondence between the volumes found in the items of clothing and the planned shape of the mould. At this time, memories are recovered of two-dimensional and three-dimensional factors (Fig. 6).

Fig. 6. Abstraction: (a) Identification of items of clothing; (b) Identification of details of the moulds.

The skirt was the element that allowed the teaching material to be prepared for an explanation of this subject. As a basis, the skirt was defined in the style that was worn in the 18th Century to establish the relation between shape and volume during a timeline. In this way, the volume given to a crinoline was re-established so that it was possible to highlight the pleated modelling and its variants with regard to its proportions (both width and length).

The framework of the crinoline which was worn as a support for skirts in the 18th and 19th Centuries, resembled the geometric shape of a cone. This was the point of departure in proposing the relation of the volume of the skirt and its structural folds over a period of time.

The importance of this image is that the plane can be traced from the volume.

In other words, what was first shown in a three-dimensional format can be revealed in a two-dimensional manner (Fig. 7).

Fig. 7. Abstraction: (a) tactile exploration of the embossed design; (b) recognition of the circular plane shape in paper; (c) identification of the volume in paper; (d) identification of volume in the crinoline- mini sculpture; (e) determining the space of the crinoline dress.

As mentioned earlier, there are two types of abstraction here and when making contact with objects, they must be investigated in different ways [15, 16]; however, this does not mean that they are processed differently in the brain. According to Gilead et al. [23], "[…] while the road from an abstract thought to concrete action appears paved and organized across fronto-parietal cortex, the opposite direction (turning a particular object into an abstraction) goes through multiple, sporadic, Less-charted paths".

Perlovsky and Ilin [24] adopt the position that the positioning of the abstraction of objects is grounded on recognizable factors (for example cultural) and hence forges a link with memory, together with the sensory perception that people have of objects or environments.

On the question of abstraction, at least three key factors are worth pointing out: (a) it occurs in the presence of a stimulus triggered by an object, e.g. an image, sound, smell, taste or texture; (b) there is a relation between the perception of the object, the memories linked to it and the appropriation of the image of this object by the brain; (c) cultural benchmark are important in so far as they act as a means of leading the abstraction to the appropriation.

These factors are significant within the teaching/learning process at several levels, particularly when those who are learning have visual impairment. However, it should not be overlooked that the same observations are applicable to students with normal sight because cerebral processes such as abstraction and appropriation are necessary for the learning of every human being. Appropriation entails a natural sequence in the process of abstraction which has a direct effect on the concept of appropriation. In other words, identification and continuous abstraction of objects means that the brain is able to make use of this information in a way that can lead to its appropriation and hence its consolidation in memory – the concept described in the next section.

4 Consolidation

Consolidation is closely linked to memory, a key factor when examining the learning process. It is a requirement of this activity that in the case of all human beings, the information obtained is in due course either saved or rejected, depending on its importance with regard to learning.

Memories are defined by their duration, i.e. whether they will last in the short, medium or long term. Each has its own particular importance in the life of an individual. Short-term memories are responsible for storing recent events and at the other extreme, there are those that involve keeping permanent records. Another way of categorizing them is to contrast the explicit memory which involves routine incidents that are dealt with on an everyday basis, with implicit memory which is linked to activities like riding a bike or brushing one's teeth. These become habits and conduct which can be recovered when requested [1].

The limbic system – a diverse set of cortical and sub-cortical regions that are essential for human behavior – is also bound up with the processing and consolidation of memory, in particular hippocampal training (explicit memory), and also the cognitive aspects of memory. As well as the Hippocampus, there is also the Amygdala brain region which

makes connections with memory processes, in so far as it takes part in the acquisition, consolidation and recording of emotional memories. This region is responsible for the processing of the circuits involved in the emotions and emotional behavior [1, 9, 19].

Estrela and Ribeiro [19] explain that it is impossible to imagine any human activity, whether it be mental, motor or affective, in which memory does not play an active role. Without memory, it would be necessary to learn everyday how to carry out the same tasks such as walking, speaking, reading, recognizing people and objects etc.

In reality, it is owing to the fact that we have a motor memory that, for example, we do not have to think about all the stages and movements necessary to blink or raise our hands. And this means that we can always be in a condition to learn something new by making use of previously acquired knowledge, which is called long-term memory.

Thus when learning something new, the memory is able to establish relations that can complement what has already been taught and thus assist in broadening knowledge of a given subject.

In the context of the Foundation module, after the blind students have followed the steps of identification, abstraction and appropriation, when they handle the items of clothing, whether garments from a past historical era or those worn today, they will begin to evoke the memories that have been consolidated until then (Fig. 8).

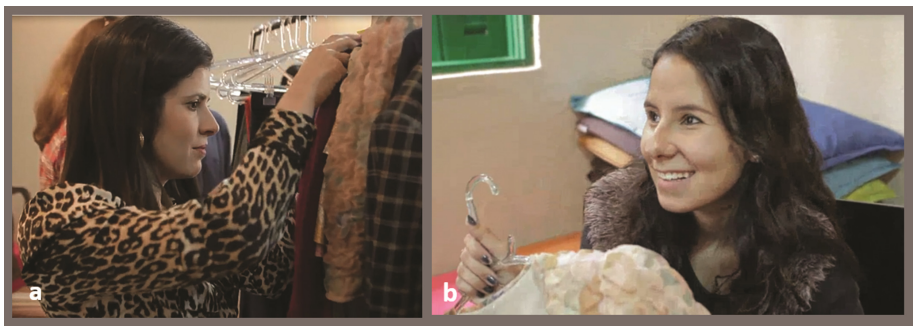

Fig. 8. Consolidation: (a) tactile observation of items of clothing on display; (b) identification of the texture of an item of clothing.

As shown above, with regard to manufactured items, these students are encouraged to grope and identify the models which are arranged and displayed on the racks. This enables them to recover their memories with regard to shapes, textures, fabrics, volumes, silhouettes, colors, prints and differences between similar models. However, these lead to results that reflect the various ways of dressing in each historical period, as well as the different materials, information about the style, modelling and textile technology, the details of sewing, finishings, materials, timmings and processing used.

In so far as the items of clothing are touched by the students and the teacher provides additional verbal explanations with regard to the frameworks and their importance for fashion design, they form the strategy of the SEE BEYOND method by evoking other memories and consolidating those that are new.

However, it is essential to bear in mind that the memory of data, events and objects can create unreliable images for the same data, events and objects. Several systems interact with different processes of acquisition, assimilation and knowledge and later, the information is consolidated that can be recorded as memory of a long duration. A short memory can recover the whole context in which it is involved since both sensitive and motor factors are required for the memory of an item of information or object [4].

Consolidation is important not only with regard to the Foundation module but also for other modules in the SEE BEYOND method, and thus in every kind of teaching/learning process.

5 Results and Discussion

The scope of this article is restricted to outlining the results and respective discussions involved in the SEE BEYOND method, with students suffering from congenital or acquired blindness. In view of the need for an in-depth study to make a comprehensive inquiry feasible, those that apply to students with normal sight will be the object of a future article.

(a) Identification: outlines and surfaces

The different degrees of visual impairment resulting from congenital or acquired blindness entail different levels of reading and interpretation of the materials given to each of the students with this kind of handicap.

With regard to the Foundation module, some strategies are adopted when giving the silhouettes and shapes of items of clothing to the students. These include: [A] a tactile board with the outlines of a figure made of embossed cotton yarn; [B] a tactile board with a figure formed of embossed dots; [C] a tactile board with the outlines of an embossed figure in cotton yarn with the areas of the fabric filled with ethylene-vinyl acetate (EVA) porous plastic material.

From their birth, the reading and interpretation of tactile boards with outlines of cotton yarn or outlines of dots [A; B] has proved ineffective for students owing to the absence of memories attached to the mental images of the two-dimensional designs and this is owing to the nature of the condition of congenital blindness itself.

In contrast, in the case of students with acquired blindness, the strategy adopted in the tactile board [A], is found to be effective as far as its objective is concerned, which is to communicate information which can be retained about the silhouettes of the items of clothing. The same thing does not apply to the strategy employed in the tactile board [B]. As was found with those suffering from congenital blindness, the reading and interpretation of the silhouette of garments by means of embossed dots, also proved to be inefficient for students with acquired blindness (Fig. 9).

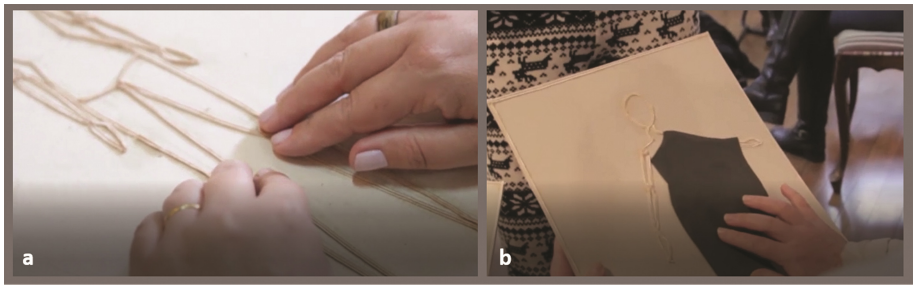

Fig. 9. (a) Identification: tactile reading of a two-dimensional embossed cord design; (b) tactile reading of a two-dimensional E.V.A mould for a design.

An effective strategy is obtained for both groups in the tactile board [C]. With the aid of this, both the students with congenital and acquired blindness are able to identify and learn the information related to the silhouette and to the shape of the garments. This shows the significant contribution made by using the space-filling two-dimensional designs. It also includes the chance to incorporate details in the items such as the pleated effects, cuttings and so on. The welcome given to this model of the tactile board by the students, is due to the fact that when they touch it, they are able to have a clearer understanding of the relation between the volume of the garment and the representation of the body which has been designed with the string.

(b) Relational Abstraction: spatial perception from the relation between the two-dimensional and three-dimensional planes

The purpose of increasing the chance of understanding the silhouettes and the shapes of the models of the dress by combining three-dimensional representations with two-dimensional designs, has proved to be a satisfactory strategy for stimulating spatial perception among both the congenital and acquired blindness groups. For this reason, the formal elements of the two-dimensional design are transposed to three-dimensional space as mini sculptures, in a way that can introduce another category of sensory-motor stimuli for the students. This resource enables the individual to form direct and simultaneous relations with the two-dimensional and three-dimensional representations, which provides them with the means to identify and understand the information regarding the designed items of clothing.

This strategy has an even more satisfactory effect on these groups when the three-dimensional representation, like the mini sculpture, is amplified to a human scale. This allows the student to appropriate the object and decide whether to drape it with a dress and feel it close to his body, and with regard to these two factors – the body and the accessory – to be aware of the surrounding space. It was found that this activity strengthens the understanding of the two-dimensional representation provided by the tactile boards. In addition, it expands the perceptual capacity with regard to the space of the classroom and the space that is formed between the body and the garment (Fig. 10).

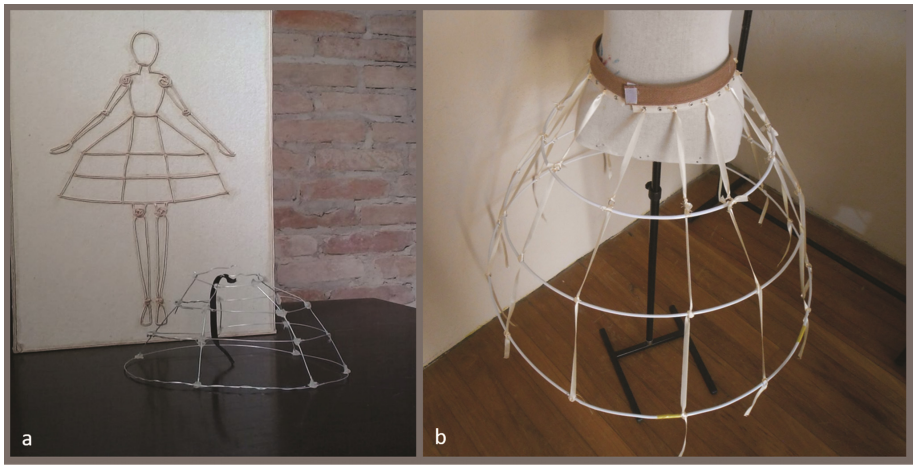

Fig. 10. Relational Abstraction: (a) the tactile board and mini sculpture; (b) crinoline in a human scale.

(c) Relational Abstraction: obstacles to linking the mould with clothes
During the stages of understanding the Foundation module, the process of transposing the parts of a two-dimensional plane mould for the volumetric structure of the three-dimensional body of the user, (in a way that can allow a garment to be made), represents another challenge to the capacity for abstraction of students with congenital or acquired blindness (relational) (Fig. 11).

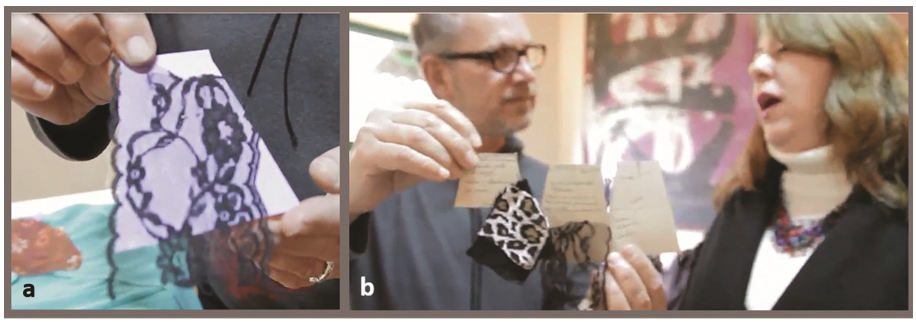

Fig. 11. Temporal Abstraction: (a) definition of the fabric for the skirt; (b) definition of the fabric for the blouse.

In the case of these individuals, there is a complete lack of any understanding about how the two-dimensional mould formed on paper or cardboard modelling, can be related or adapted to the curves of the body shape. In other words, the capacity for relational abstraction which is required by this process is shown to be no longer applicable because of the methodological convention adopted in lessons on modelling, which recommends teaching this from a mould made of paper (Fig. 12).

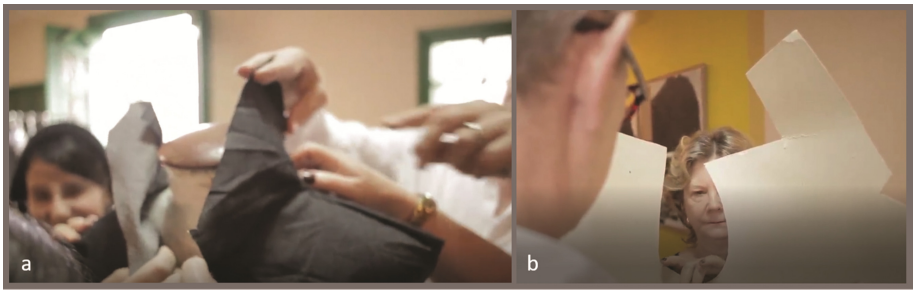

Fig. 12. Relational Abstraction: (a) recognition of the coat on a bust for modelling; (b) recognition of the mould of a coat.

The reversal of the stages in the process referred to can be configured as a responsible strategy for evoking consolidated memories about the structure of the manufactured dress to stimulate the relational abstractions needed for an understanding of how the dress and the mould should match. In other words, the initial stimulus begins to be the item of clothing mounted on the modelling bust and not the mould made of paper. From this, it can be determined to what extent it has a significant capacity to empower the relational abstraction of the students in question [32].

(d) Temporal Abstraction: challenges to the creative process

Within the Foundation module, the stage of conceiving and designing a ¨look¨, which is carried out on the basis of the information identified and learnt in the previous stages, reveals a significant difficulty arising from temporal abstraction for students with congenital and acquired blindness.

A challenging time is revealed that is full of anxiety and feelings of insecurity and this stems from the long periods of response to sub-objectives, even though all the sub-objectives have been assimilated. It involves: (i) obtaining an idea of their body measurements; (ii) understanding the design of the mouldings which represent their shapes and volumes; (iii) recognizing the different types of textile substrates; (iv) knowing the right time when these factors can be transposed into the planning of a ¨look¨ [a more abstract objective].

Even if the students feel they are able to apprehend the sub-objectives, they raise doubts about their own capacity for abstraction or in other words, new kinds of planning [the creative process] based on the memories consolidated until that time, whether they arise from knowledge acquired in the classroom or from their own private collection.

This conflict can only be overcome through a series of activities carried out by the teacher together with the students which is devoted to strengthening the sensory-motor stimuli and evoking memories.

(e) Appropriation: consolidated experience as a skill

The concept of appropriation is inherent in the progress made in each stage of the Foundation module. However, when undertaking the creation of a ¨look¨, this concept is much in evidence (Fig. 13).

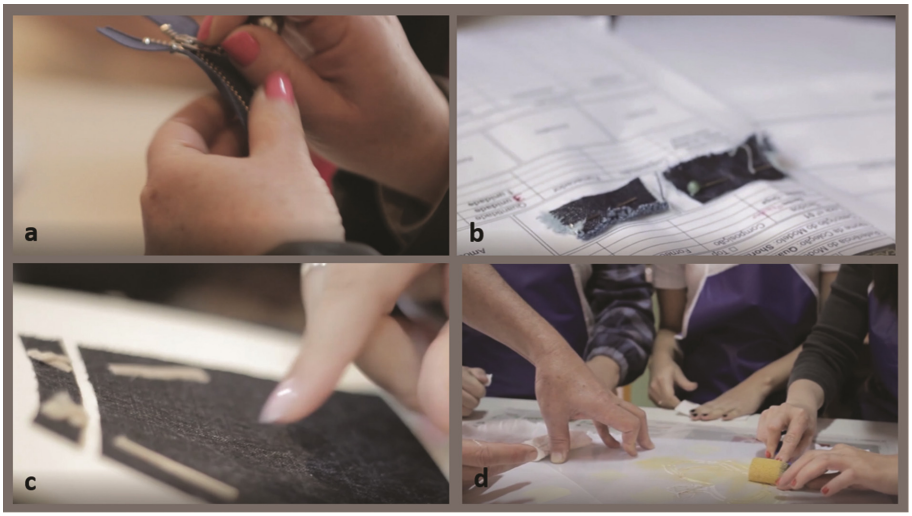

Fig. 13. Appropriation: (a) choice of trimming proportions; (b) definition of fabric; (c) tactile board with a model of the collection; (d) test of hand-made items.

This emphasis derives from associations between the memories that are formed and consolidated while this learning is obtained in this stage of the SEE BEYOND method. Moreover, it involves the individual ideas of each student for planning a project about clothes, which includes the definition of the projected design [shape, silhouette, color, fabrics, frameworks, modelling, trimming, finishing and processing]. In other words, the complexity of this planned process requires the capacity for appropriation of the student to be grouped on a particular skill. In this case, it is of crucial importance for the stimulus to be identified with the pro-activity, curiosity and creativity of the students with congenital or acquired blindness, as a strategy which can strengthen this skill.

(f) Consolidation: recognition and self-criticism

The detection of problems or defects in the prototype of the dress that will be manufactured, is aimed at making corrections and adjustments, and carried out (in a significant contribution to the acquisition of knowledge) during the sessions that are devoted to forming the Foundation module. This derives from the fact that the prototype will be tested on the bodies of students themselves with congenital or acquired blindness and not on the body of a mannequim, as is usually the case in fashion design. This means that in the body itself, it is possible to recognize if there is perhaps a lack of correspondence between the model created, the modelling carried out and the manufactured product obtained. Hence the planned choices of the students are not only provided but also felt in their bodies and this enables them to be self-critical about them (Fig. 14).

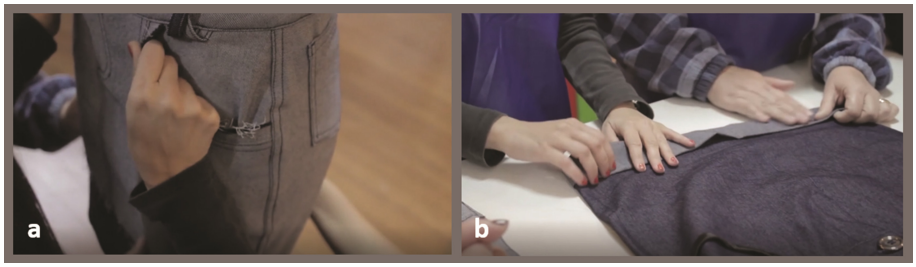

Fig. 14. Consolidation: (a) a clothes test; (b) finding the defects in an item of clothing.

6 Conclusion

The way information is received by students with normal sight differs from what has been found in the domain of those with visual impairment, where oral explanations are easily assimilated. However, a lack of vision has a direct effect on the recognition time of tactile information, which requires more time for a complete apprehension by the blind student.

In this area, the SEE BEYOND method is designed for planning and providing access to pedagogical and andragogical resources which can overcome the obstacles to the inclusion of people with visual impairment in higher education Fashion Design courses. This particularly involves helping them to become accustomed to creating fashion collections and carrying out the necessary steps for preparing them.

This article focused on the Foundation module, the first of the three modules that underpin the SEE BEYOND method, and explored the way it is interwoven with the neuroscientific concepts of Identification, Abstraction, Appropriation and Consolidation. The purpose of this was to pursue lines of thought about the perceptive process of people with congenital and acquired blindness, and the extent of collaboration in the conception and application of material suitable for the visually handicapped and aimed at planned learning.

The main positive outcomes that emerged from the observed results were as follows: (a) the adoption of ¨areas for filling activities¨ that were associated with two-dimensional design, proved to be a satisfactory strategy to enable students to perceive contours and surfaces, as well as the details involved; (b) the use of three-dimensional shapes was shown to be of crucial importance for spatial perception and forging a link between two-dimensional and three-dimensional representations. This was the case when the method was applied between the moulds and the items of clothing; (c) the information assimilated in the classroom did not guarantee the capacity for abstraction that is needed for the creative process. Hence, the participation of a teacher devoted to strengthening the sensory-motor stimuli and evoking memories, was found to be an overriding factor in the consolidation of knowledge and the strengthening of the skills of the students; (d) the reversal of the stages of the already established methodology might represent a necessary strategy for the apprehension of the teaching content learnt by the students. This is exemplified here by the exchange involved in the initial stimulus – a garment

mounted on the dummy model, instead of a mould made of paper, as a point of departure to make it possible to understand the correspondence between the garment and the mould; (e) stimulating the pro-activity, curiosity and creativity of the student, as well as establishing a link between their personal experiences and what is learnt in the classroom. This proved to be essential to consolidate the kind of skills needed to carry out the projects; (f) the exercise of self-criticism was seen to be essential for the consolidation of learning. Within the method, there was thus evidence of ideas about planned choices when there was a correlation between the created model, the modelling carried out and the final manufactured object.

Further studies will focus on the results and achievements derived from the application of the Foundation module to students with normal sight with a view to broadening the perceptive capacities of this group and the benefits flowing from creative and practical planning. As well as this, future studies will address the two other modules that underpin the SEE BEYOND teaching method: Empowerment and Materialization.

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