ORIGINAL ARTICLE

Validation of the arts therapies process monitoring scale in psychiatric settings

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Abstract

OBJECTIVES: Arts Therapies (ATs) use artistic tools to promote patient well-being, improving cognitive, affective, expressive and relational dimensions. Several tools evaluate the outcomes of ATs, but one applicable to all forms of ATs is lacking. The aim of this study was to validate the Arts Therapies Process Monitoring Scale (in Italian: Scheda di Monitoraggio del Processo nelle Artiterapie; SMPA) to evaluate the clinical effectiveness of ATs in psychiatric settings.

METHODS: A Technical in-depth Analysis Group (in Italian: Gruppo di Approfondimento Tecnico; GAT) developed the 58 items of SMPA and rated a detailed user's Manual. SMPA was applied by 24 specifically formed arts therapists on a sample of 101 patients attending the arts laboratories of GAT's psychiatric services. The exploratory and confirmatory factor analysis of the data was carried out using the statistical package LiSRel version 8.8, applying the maximum likelihood (ML) solution method for both exploratory and confirmatory solutions.

RESULTS: SMPA is composed of thematic dimensions associated with the following latent traits: cognitive area, relational area, expressive area, psycho-educational area, global evaluation, climate. All dimensions have shown a high internal consistency with high statistical reliability indices as shown by the structural adequacy indices of the elaborated structural equation models.

CONCLUSION: SMPA has good psychometric properties and detects an individual profile along the above dimensions. SMPA can be applied for all ATs without changing the usual ATs procedure, supports a multidimensional and longitudinal observation of psychiatric patients in different contexts, and allows the verification of the effectiveness of the treatments.

INTRODUCTION

Arts Therapies (ATs) are widely defined as a type of psychotherapy that uses artistic media as the primary mode of expression (British Association of Art Therapists, 2015). Despite this general definition, ATs refer to several therapeutic techniques, including art therapy, dance movement therapy, drama therapy, writing therapy, and music therapy (NICE, 2014). By using various creative and artistic tools, ATs encompass different communication channels, such as the sensory, cognitive, pragmatic, imaginative, and intuitive ones, as well as diversified expressive skills, like verbal, non-verbal, and artistic ones (Karkou & Sanderson 2006; Melorio, 2019; Fancourt & Finn 2019; Viganò *et al.* 2019). Through the involvement of the above-mentioned aspects, ATs promote changes with the intent of empowering patients' personal growth (British Association of Art Therapists, 2015).

In the last century, the application of ATs has significantly increased, especially in the treatment of psychiatric conditions (Volpe *et al.* 2016; Viganò *et al.* 2023). In this field, ATs are particularly suitable when there is an impediment in the verbal expression of the emotional experience, as during psychosis or severe depressions: by activating the patient's preferential sensory channel, they act as a relational and symbolic mediator and promote the therapeutic relationship (Pistorio *et al.* 2000; Ba *et al.* 2003). Hence, ATs have been studied as adjunctive treatments for several psychiatric conditions, as psychotic, affective, substance use, and trauma-related disorders (Grocke *et al.* 2014; Levine & Land, 2016; Aalbers *et al.* 2017). In this perspective, the National Institute for Health and Clinical Excellence (NICE) strengthened the importance of offering psychological therapies, including ATs, in conjunction with medication to support individuals with psychosis and schizophrenia through their recovery (NICE, 2014).

However, to date, since evidence regarding ATs' efficacy in psychiatric disorders is somewhat inconsistent (Attard & Larkin, 2016; Carr *et al.* 2013; Chung & Woods-Giscombe 2016), the role and the impact of ATs are still debated (Crawford *et al.* 2012; Hu *et al.* 2021). Meta-analyses and systematic reviews analysing the efficacy of ATs in psychiatric disorders are limited. For instance, research evaluating 15 randomized controlled studies showed ATs to be associated with a significant improvement of nonpsychotic symptoms (Uttley *et al.* 2015). However, a recent narrative review on the application of ATs in severe mental illness, concluded that, even though ATs appear to be a valuable intervention, their clinical use has been limited by the lack of methodological rigor, and inconsistency in study methods and outcome measures (Chiang *et al.* 2019). Thus, it is critical to define new research hypothesis in methodologically more robust studies (Springham & Brooker, 2013).

A fundamental challenge in art therapy research today is to find a method and a perspective that responds to the complexity of the intervention that we want to evaluate, understanding the process that leads to concrete results; so it is necessary to carry out methodologically sound researches but focused on the analysis of the specific process that distinguishes Ats.

Multiple outcome measures were used but not always specific to investigate all the dimensions on which these techniques act. Art therapists have developed specific scales and methods for each type of AT to measure basic deficits in their daily practice for the various types of ATs (i.e. Bucharovà *et al.* 2020). For example, art therapists may use formal elements of visual expression such as color, shape, and size as a way to help determine clients' cognitive and emotional functioning (Betts, 2006); music therapists may use musical sound production such as intensity, rhythmic pulse, harmonic structure, melody (Raglio *et al.* 2017; Carr et al. 2013); while for dance therapy the Laban Movement Analysis system may be a helpful method for the description of the dynamics and rhythms of human movement's evolutions (Federman, 2011).

These assessments are very specific, often not directly translatable into clinical language (Priebe 2021; Melorio, 2022) and do not assess all psychopathological domains (Chiang *et al.* 2019); on the other hand, many psychiatric assessments may not be the most appropriate targets for ATs or capture what participants found helpful in them (Attard & Larkin 2016; Chiang *et al.* 2019).

Kazdin (2017) suggest that developing a language to describe how arts therapeutic processes influence patients' outcomes is important to make sense of clinical practice in relation to empirical research.

In this perspective, some authors have suggested that quality of research could benefit from a clearer language (Springham & Brooker, 2013), others from a simpler one (Kelly *et al.* 2015).

We agree that a more detailed description of change and a common language can promote communication with clinicians and researchers who are unfamiliar with art therapy. Havsteen-Franklin *et al.* (2017) argue that a shared language about ATs actions in clinical work would help make sense of observational studies, so new assessment tools should be developed in addition to established psychiatric rating scales in order to accurately measure the full benefits of ATs (Chiang *et al.* 2019).

The focus of all ATs is on the transformative processes activated by sensoriality and physicality (aesthetic dimension) and arts therapists tend to have a common language considering the role of the arts as interconnected, overcoming the division into separate artistic disciplines by emphasizing the importance of creativity as primary within the process (Karkou & Sanderson, 2006). All the various forms of ATs have specific factors linked to artistic making and they all share the same

underlying mechanisms: agency, embodiment, implicit interpersonal communication, creativity, relational aesthetics, artistic pleasure and playfulness, experience of beauty, modulation of time and space (flow state), non-verbal expression (De Witte *et al.* 2021.) These ATs' specific factors are added to more general factors common to psychotherapies: specific setting, strong therapeutic alliance, work in the here and now to facilitate the expression and clarification of thoughts and feelings, promote insight, development of cognitive and emotional skills (De Witte *et al.* 2021; Carr *et al.* 2021). So, the process of transformation in ATs implies a change that includes many common aspects: cognitive, affective, relational, behavioural, expressive, in parallel with the improvement or despite the stationarity of the pathology in progress (Attard & Larkin 2016; Viganò *et al.* 2019; Melorio, 2019).

On these premises the aim of the present research was to construct and validate an instrument measuring specific effects and outcomes of all ATs' by involving expert clinicians and arts therapists.

We first identified the common factors that usually activate ATs' process, based on the literature and clinical experience, with the intent of using them as clinical and observable indicators of ATs' induced changes. Then, we developed an instrument that could be applied without modifying the usual ATs' procedure and that could be transversally suitable for each ATs. The hetero-administered instrument was based on a clear theoretical background and, having verified its psychometric properties, it can be used to evaluate the process and outcome of the Ats.

Material & methods

This study comes from the experience of clinicians and arts therapists of a technical team (GAT) promoted by the General Welfare Direction of the Lombardy Region. The GAT involved 31 expert clinicians (psychiatrist and psychologists) and 29 arts therapists (music therapists, drama therapists, dance-movement therapists and art therapists) working in 27 Departments of Mental Health and Addiction (in Italian: Dipartimenti di Salute Mentale e Dipendenze; DSMDs) of the Lombardy Region who agreed, in accordance with literature (Havsteen-Franklin *et al.* 2017; Carr *et al.* 2021; Melorio, 2022), to identify general and common categories to describe clinical outcomes in ATs.

The GAT started in 2017 to monitor the diffusion of ATs in the DSMDs of the Region to define and share good practices and to identify any indicators for the evaluation of the change process during ATs. GAT shared the definition of art therapy as a relationship that fosters a process of transformation through the languages of art. In the analysis of good practices, it was agreed that a meaningful and stable relationship is promoted through making art together, which

is fundamental for the goal of overcoming mental discomfort. (Melorio, 2019, 2022; Errepiesse XIII, 2019; Priebe, 2021).

The Arts Therapies Process Monitoring Scale was developed starting from a previous sheet created by the operators of the Arts Workshops of the ASST Niguarda (Baccei *et al.* 2019). A proceeding conference was designed to discuss how to translate in a shared language what happens in all areas of ATs including art, music, dance, theatre and writing (Errepiesse XIII, 2019).

In a subsequent step, the GAT experts (involving psychiatrists, psychologists, educators and art therapists from different artistic disciplines) developed the SMPA. The items were formulated by experts in the field describing the observations that art therapists commonly make on patients during activities. The procedure refers to the indications of other studies (Havsten-Franklin *et al.* 2017; Holmqvist el al. 2017; Melorio, 2022) regarding the need to better define the various aspects of the therapeutic process in AT and to verify the sharing of language between the various types of ATs and clinicians.

The Scale is supplemented by a manual with a detailed explanation of all the items, so that the scale could be interpreted and compiled objectively. To draft the manual, four versions were produced by four experts who worked independently on the explanation of the items. Subsequently, the four versions were collegially discussed under the supervision of a psychiatrist and a psychologist from the University of Milan and the final version was drawn up, shared and approved by the entire working group.

Materials
The Arts Therapies Process Monitoring Scale (SMPA)
The final version of SMPA is composed by an Introductory section for socio-demographics variables, type of service and expertise of the operator involved, type of activity carried out, materials used, therapy setting (individual or group, and in the latter case number of participants). A second section comprises some specific areas of assessment: Cognitive area (11 items, for example "Understanding skills"), Relational area (8 items, for example "Ability to relate to the art therapist"), Expressive area (10 items, for example "Ability to express desires"), and Psycho-educational area (7 items, for example "Ability to carry out a project"); it also includes a Global evaluation (14 items, for example "Involvement") and Climate (8 items, for example "Positive comments"). The inner structure of SMPA is showed in Appendix A.

SMPA is composed of some thematic dimensions that can be associated with the following latent traits: cognitive area, relational area, expressive area, psycho-educational area, global evaluation, climate.

Following the first statistical analyses, item 9 and its relative explanation in the Manual were elimi-

nated from the final version of the scale; consequently, the final Cognitive area is composed of 11 items. All items on the scale have a 6-point Likert response form, whose possible answers are 0 (not evaluable or in cases where the examiner deems no other answer possible), 1 (never), 2 (rarely), 3 (sometimes), 4 (often), 5 (almost always) and 6 (always).

Participants
To verify the psychometric properties of SMPA, the scale was applied by art therapists of various disciplines on a sample of patients, clinically stable, referred to the psychiatric services of the GAT.

SMPA were collected by 24 art therapists in 18 laboratories operating in the GAT services.

Tested subjects were included in the care programs shared in the team according to the good practices approved in the GAT. All arts therapists had accredited training in their discipline and trained on the SMPA user's Manual.

Statistical analysis
In the psychological and social sciences, latent constructs that are not directly measurable are often used. The class of models suitable for this type of measurement is indicated, in general, as factorial analysis, and the relative calculation techniques are indicated as follows: exploratory factorial analysis, if there are no assumptions about the number of factors underlying the variables or their characteristics, and confirmatory factorial analysis, if these assumptions can be formulated a priori by the theoretical model of analysis. Exploratory factorial analysis establishes correlational links between all the observed variables and all the latent traits (all of them); whereas confirmatory factorial analysis establishes correlational links only between some observed variables and the latent traits of which they are the only measures. Both confirmatory and exploratory factorial analysis can be obtained from the algebraic model presented in Equation 1 and 2. For this model class, it is possible to derive the existing metric relationship between the model parameters and the matrix of observed variances–covariances between the measurements of the latent traits. This relation is formally expressed with the basic equation of the factorial analysis:

$$\Sigma_{xx} = \Lambda_x \Phi \Lambda'_x + \Theta_\delta \qquad (1)$$

in which Σ_{xx} is the variance–covariance matrix expected by the model and estimated from the parameters Λ_x and Θ_δ of the model presented in Equation 2; while Φ is the covariance matrix between the latent factors ξ. Equation 1 shows how the factorial structure can be reproduced by the model in terms of variance–covariance matrices between the exogenous observed variables x regarding expected values, that is, the relationship is valid $\Sigma_{xx} = E(X'X)$.

Equation 1 derives from the substitution of variables X, internal to the operator of expected value E, with formal equality presented in basic Equation 2. Algebraically it is possible to recognize that:

$$\Sigma_{xx} = E[(\Lambda_x\xi + \delta)(\Lambda_x\xi + \delta)')] = \Sigma_{xx} = \Lambda_x\Phi\Lambda'_x + \Theta_\delta. \quad (2)$$

Below is, in matrix form, the factorial model of Equation 2 for parameter estimation Λ_x, Φ is Θ_δ, in relation to Equations 1 and 2.

The algebraic linear model can be expressed in matrix form as follow:

$$X = \Lambda_x \xi + \delta$$

$$\begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_q \end{bmatrix} = \begin{bmatrix} \lambda^x_{11} & \lambda^x_{12} & \dots & \lambda^x_{1n} \\ \lambda^x_{21} & \lambda^x_{22} & \dots & \lambda^x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \lambda^x_{q1} & \lambda^x_{q2} & \dots & \lambda^x_{qn} \end{bmatrix} \begin{bmatrix} \xi_1 \\ \xi_2 \\ \vdots \\ \xi_n \end{bmatrix} + \begin{bmatrix} \delta_1 \\ \delta_2 \\ \vdots \\ \delta_q \end{bmatrix}$$

The model, to be identified, needs both the variance–covariance matrix Φ among the latent trats ξ and of the variance–covariance matrix Θ_δ:

$$\Phi = \begin{bmatrix} \phi_{11} & \phi_{12} & \dots & \phi_{1n} \\ \phi_{21} & \phi_{22} & \dots & \phi_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \phi_{q1} & \phi_{q2} & \dots & \phi_{qn} \end{bmatrix} \qquad \Theta_\delta = \begin{bmatrix} \theta^\delta_{11} & \theta^\delta_{12} & \dots & \theta^\delta_{1n} \\ \theta^\delta_{21} & \theta^\delta_{22} & \dots & \theta^\delta_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \theta^\delta_{q1} & \theta^\delta_{q2} & \dots & \theta^\delta_{qn} \end{bmatrix}$$

RESULTS

The sample was composed by 101 patients, age 18–69 yrs (mean age = 44.9).

Patients had the following diagnoses: N = 43 schizophrenia, 16 personality disorders, 16 Psychosis, 8 bipolar disorder, 6 depressive disorder, 3 obsessive compulsive disorders, 9 neurotic disorders.

The ATs activities were: N = 57 Art therapy, 23 Music therapy, 13 Drama therapy, 6 Dance therapy, 2 Writing therapy. Group activities were 84%, and individual activities were 16%.

The exploratory and confirmatory factor analysis of the data was carried out using the statistical package LiSRel version 8.8, (Jöreskog & van Thillo, 1973; Jöreskog & Sörbom, 1988) applying the maximum likelihood (ML) solution method for both exploratory and confirmatory solutions. Inside the next sections will be displayed the structural composition of each dimensional component obtained from the statistical analysis under confirmatory factorial analysis (Bollen, 1989).

Dimensionality analysis: Cognitive component
Table 1 shows the descriptive statistics. The cognitive dimension has two subscales that identify the latent traits related to: "application of higher cognitive functions" (Items: 4,5,6,7,10,11) and "ability to persist" (items

Tab. 1. Descriptive statistics for the *Cognitive area*

Descriptives	v1	v2	v3	v4	v5	v6	v7	v8	v10	v11
Mode	6.00	5.00	5.00	6.00	5.00	5.00	5.00	5.00	6.00	5.00
Median	5.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00	4.00
Mean	4.54	4.36	4.20	4.35	3.93	3.70	4.11	4.34	4.48	3.92
Std. Deviation	1.24	1.20	1.21	1.27	1.38	1.52	1.38	1.26	1.25	1.40
Skewness	-0.33	-0.33	-0.11	-0.14	-0.13	-0.21	-0.55	-0.39	-0.37	-0.45
Std. Error of Skewness	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
Kurtosis	-1.14	-0.77	-1.13	-1.13	-1.14	-0.74	0.12	-0.93	-0.71	-0.42
Std. Error of Kurtosis	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48
Minimum	2.00	2.00	2.00	2.00	1.00	0.00	0.00	2.00	1.00	0.00
Maximum	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00

Tab. 2. Confirmatory factor Analysis (standardized solution) for the *Cognitive area*

	Application of higher cognitive functions (FC_1)		Ability to persist (FC_2)		
Cognitive area	λ^x	θ^d	λ^x	θ^d	R^2
V_4	**0.90**	0.18	-	-	0.81
V_5	0.82	0.33	-	-	0.67
V_6	**0.87**	0.24	-	-	0.79
V_7	0.83	0.31	-	-	0.70
V_{10}	0.84	0.30	-	-	0.68
V_{11}	**0.85**	0.28	-	-	0.72
V_1	-	-	0.87	0.24	0.75
V_2	-	-	**0.96**	0.08	0.93
V_3	-	-	**0.92**	0.16	0.84
V_8	-	-	0.77	0.41	0.59

Notes: Standardized solution for Fc1: "awareness of one's own actions" and Fc2: "ability to persist"

1,2,3,8). This structure was subjected to a preliminary exploratory factor analysis and subsequently confirmed based on the formal model presented in the previous section (see Eq. 1 and Eq. 2).

The set of involved items and their relative contribution in terms of lambda-x parameters are shown in Table 2. The linear structural model is show in Figure 1. The LISREL 8.8 syntax code has been included in the Appendix B.

The latent trait called "application of higher cognitive functions" is inferred based on a set of observed indicators of which it causes. Specifically, in order of importance in the constitution of the latent trait, the indicators for this theoretical dimension are: V4 comprehension skills (0.90), V6 abstract thinking skills (0.87), V11 emotional understanding skills (0.85), V10 ability to select (0.84), V7 route memory capacity (0.83), V5 non-verbal communication skills (0.82). The latent trait that characterizes the second subscale is identified as the "ability to persevere" which objectivies the ability to remain focused on an objective which is inferred

from the indicators: V2 attention span (0.96), V3 ability to focus (0.92), V1 presence to oneself, awareness of the here and now (0.87), V8 ability to maintain work continuity during activities (0.77). Item n. 9 (ability to recognize one's own product) was excluded as not relevant in defining the internal factorial structure of the two latent traits. The correlation between the two latent traits is r = 0.90 indicating that there is very little independence between them. It was considered appropriate to keep the subdivision into two subscales to interpret the collected data with more precision. Table 3 shows the main goodness of fit indices for this theoretical dimension.

Dimensionality analysis: Relational component
The relational area is made up of items 12-19 (see Appendix A) and the structural components can be identified into three sub-scales: respectively made up of the latent traits "relationship skills" (Fc1) (Items: 12,13,16), "compliance with the rules" (Fc2) (Items: 17,18,19) and "peer relationships" (Fc3) (Items: 14,15).
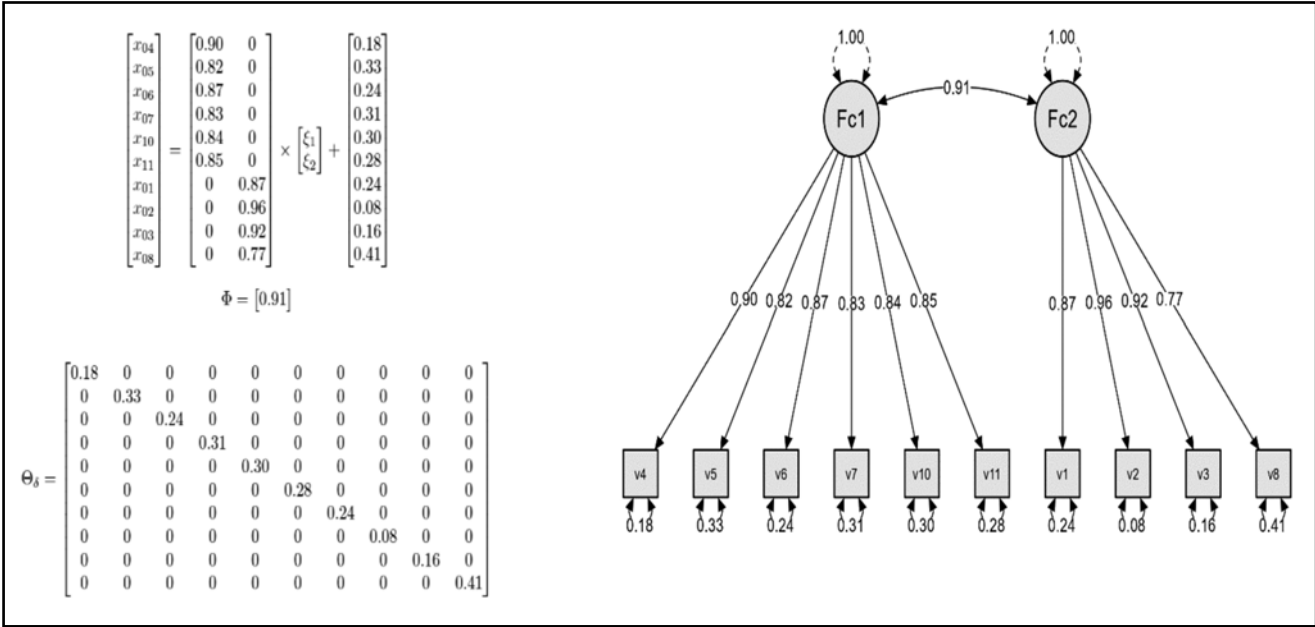
Fig. 1. Linear structural model for the *Cognitive area*

Tab. 3. Standardized Goodness of fit indices for the *Cognitive area*

Goodness of fit indices	CFI[1]	NFI[2]	PNFI[3]	RMSEA[4]	GFI[5]	SRMR[6]
Cognitive area	0.95	0.92	0.72	0.11	0.86	0.04

Notes: (1) Comparative Fit Index; (2) Normed Fit Index; (3) Parsimony Normed Fit Index; (4) Root Mean Square Error of Approximation; (5) Goodness of Fit Index; (6) Standardized root mean square residual.

Tab. 4. Descriptive statistics for the *Relational area*

Descriptives	v12	v13	v14	v15	v16	v17	v18	v19
Mode	3.00	5.00	3.00	3.00	6.00	6.00	6.00	5.00
Median	4.00	5.00	4.00	4.00	4.00	5.00	5.00	4.00
Mean	3.70	4.53	3.41	3.69	4.49	4.80	4.64	4.05
Std. Deviation	1.28	1.14	1.72	1.61	1.35	1.31	1.35	1.39
Minimum	1.00	2.00	0.00	0.00	0.00	2.00	1.00	0.00
Maximum	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00

Descriptive statistics for the relational component are showed in Table 4.

The first subscale (Table 5) identifies the "relationship skills" sub-factor which conveys information regarding the ability to get in touch and entrust oneself to the therapist and to share the product with the public. The items that characterize this latent trait are: V13 ability to relate to the group (0.93), V12 ability to relate to the art therapist (0.74), V16 ability to take care of space and materials (0.74). The second sub-dimension frames the component relating to compliance with the rules and is outlined by the items: V17 ability to comply with schedules and rules (0.82) V19 ability and willingness to share one's own artistic product (0.79), V18 ability to relate to materials and artistic means (0.64).

Finally, the third sub-dimension establishes a link with the other two dimensions by investigating the aspects inherent in defining interpersonal relationships with peers; the indicator variables are: V15 ability to trust other people (0.94), and V14 ability to maintain balance between taking time and occupying space and leaving time and space for others (0.55).

As can be seen from the graph (Figure 2), all the factorial components show a fair degree of correlation which indicates that these latent traits cannot be considered independent of each other (the values of the phi parameters are all significantly different from zero (0.71, 0.57, 0.48). Table 6 shows the main goodness of fit indices for this theoretical dimension.

Dimensionality analysis: Expressive component
Table 7 shows the descriptive statistics. The expression of the artistic gesture called "Expressive" area conveys the latent tract information mediated by the items' set ranking from V21 to V30 of the questionnaire (compare Appendix A for details). Descriptive statistics for this area have been given in Table 7 whereas the internal

Tab. 5. Confirmatory factor Analysis (standardized solution) for the *Relational area*

Relational area	Relationship skills (FC$_1$)		Compliance with the rules (FC$_3$)		Peer relationships (FC$_3$)		
	λ^x	θ^d	λ^x	θ^d	λ^x	θ^d	R^2
V$_{12}$	0.74	0.45	-	-	-	-	0.55
V$_{13}$	**0.93**	0.14	-	-	-	-	0.86
V$_{16}$	0.74	0.45	-	-	-	-	0.55
V$_{17}$	-	-	**0.82**	0.33	-	-	0.67
V$_{18}$	-	-	0.64	0.59	-	-	0.41
V$_{19}$	-	-	0.79	0.37	-	-	0.63
V$_{14}$	-	-	-	-	0.55	0.70	0.30
V$_{15}$	-	-	-	-	**0.94**	0.11	0.89

Notes: Standardized solution for Fc1: "Relationship with the reference person", Fc2: "Compliance with the rules" and Fc3: "Interpersonal relationships with peers"
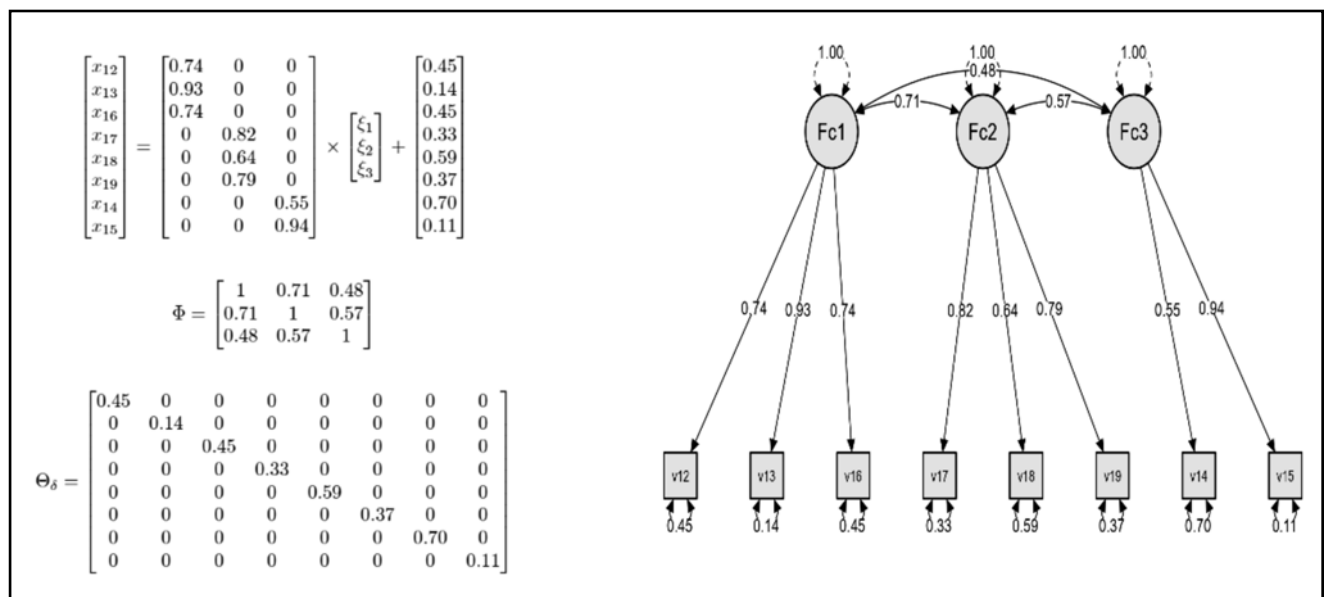

Fig. 2. Linear structural model for the *Relational area*

Tab. 6. Standardized Goodness of fit indices for the *Relational area*

Goodness of fit indices	CFI[1]	NFI[2]	PNFI[3]	RMSEA[4]	GFI[5]	SRMR[6]
Relational area	0.90	0.86	0.52	0.14	0.90	0.07

Notes: (1) Comparative Fit Index; (2) Normed Fit Index; (3) Parsimony Normed Fit Index; (4) Root Mean Square Error of Approximation; (5) Goodness of Fit Index; (6) Standardized root mean square residual

Tab. 7. Descriptive statistics for the *Expressive area*

Descriptives	v20	v21	v22	v23	v24	v25	v26	v27	v28	v29
Mode[(1)]	5.00	3.00	3.00	3.00	3.00	3.00	4.00	4.00	3.00	4.00
Median	4.00	4.00	4.00	3.00	3.00	4.00	4.00	4.00	3.00	3.00
Mean	3.87	3.82	3.77	3.40	3.19	4.13	3.75	3.56	3.22	3.45
Std. Deviation	1.38	1.23	1.31	1.29	1.25	1.29	1.33	1.52	1.47	1.57
Minimum	1.00	1.00	1.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00
Maximum	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00

Notes: (1) More than one mode exists, only the first is reported

$$\begin{bmatrix} x_{20} \\ x_{21} \\ x_{22} \\ x_{23} \\ x_{24} \\ x_{25} \\ x_{26} \\ x_{27} \\ x_{28} \\ x_{29} \end{bmatrix} = \begin{bmatrix} 0.92 \\ 0.89 \\ 0.87 \\ 0.88 \\ 0.89 \\ 0.61 \\ 0.75 \\ 0.86 \\ 0.83 \\ 0.55 \end{bmatrix} \times [\xi_1] + \begin{bmatrix} 0.15 \\ 0.20 \\ 0.24 \\ 0.23 \\ 0.21 \\ 0.62 \\ 0.43 \\ 0.25 \\ 0.30 \\ 0.70 \end{bmatrix}$$

$$\Phi = [1]$$

$$\Theta_\delta = \begin{bmatrix} 0.15 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0.20 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.24 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.23 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0.21 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0.62 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0.43 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.25 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.30 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.70 \end{bmatrix}$$
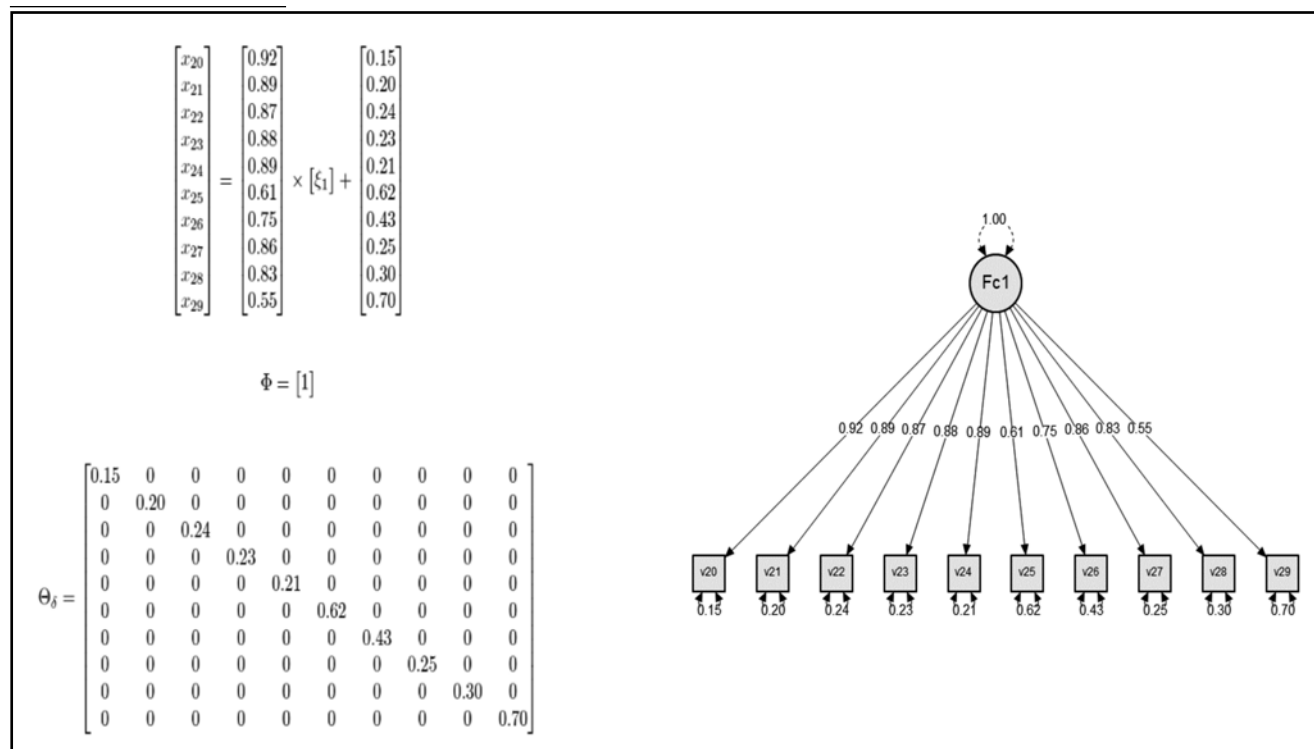
Fig. 3. Linear structural model for the *Expressive area*

Tab. 8. Confirmatory factor Analysis (standardized solution) for the *Expressive area*

Expressive	Expressive (FC$_1$)		
	λ^x	θ^d	R^2
V$_{20}$	**0.92**	0.15	0.85
V$_{21}$	**0.89**	0.20	0.80
V$_{22}$	**0.87**	0.24	0.76
V$_{23}$	**0.88**	0.23	0.77
V$_{24}$	**0.89**	0.21	0.79
V$_{25}$	0.61	0.62	0.38
V$_{26}$	0.75	0.43	0.57
V$_{27}$	**0.86**	0.25	0.75
V$_{28}$	0.83	0.30	0.70
V$_{29}$	0.55	0.70	0.30

Notes: Standardized solution for Fc1: "Expressive area"

organization of the subscale were shown in Table 8. The linear structural model is show in Figure 3. The LISREL 8.8 syntax code has been included in the appendix D.

Items 25, 26 and 29 represent the least effective evaluation nucleus within the "Expressive" dimension and are attributable respectively to the questions: V25 ability to express satisfaction with the finished product (0.61), V26 ability to devote adequate time to artistic creation (0.75) and V29 ability to use non-verbal language (0.55). These items are less informative than the factor for which the results tend to indicate a possible attention action, for the thematic areas under observation, by the arts therapists.

At the same time, the items that mostly represent the factor are: V20 creative ability (0.92), V21 ability to use one's own resources (0.89), V24 ability to face the artistic unexpected and find new solutions (0.89), V23 ability to vary the contents expressive (0.88), V22 ability to express wishes (0.87), V27 ability to choose (0.86), V28 ability to modify the technique in relation to one's creative desire (0.83).

In this area all the variables making up the latent trait "Expressive" seem to provide the same level of structural information; item 29 however seems to have a marginal role in the definition of the latent trait. This is plausible as arts therapies techniques are specifically aimed at improving communication at all levels of analogical language. Regarding the evaluation of this last type of language, it must be emphasized that although it is transversal to all expressive-artistic forms, it can be modulated according to the art that is practiced. Table 9 shows the main goodness of fit indices for this theoretical dimension

Tab. 9. Standardized Goodness of fit indices for the *Expressive area*

Goodness of fit indices	CFI[1]	NFI[2]	PNFI[3]	RMSEA[4]	GFI[5]	SRMR[6]
Expressive area	0.92	0.89	0.69	0.15	0.82	0.05

Notes: (1) Comparative Fit Index; (2) Normed Fit Index; (3) Parsimony Normed Fit Index; (4) Root Mean Square Error of Approximation; (5) Goodness of Fit Index; (6) Standardized root mean square residual

Tab. 10. Descriptive statistics for the *Psycho-educational area*

Descriptives	v30	v31	v32	v33	v34	v35	v36
Mode	3.00	3.00	3.00	3.00	5.00	3.00	3.00
Median	3.00	3.00	4.00	3.00	4.00	3.00	3.00
Mean	3.62	3.63	3.79	3.55	4.32	3.60	3.35
Std. Deviation	1.30	1.51	1.32	1.18	1.21	1.52	1.34
Minimum	1.00	0.00	0.00	1.00	2.00	0.00	0.00
Maximum	6.00	6.00	6.00	6.00	6.00	6.00	6.00

Dimensionality analysis: Psycho-educational component

In this subscale the items describe the subject's ability to identify and use their own resources to express their emotions inside the scheduled laboratory activities. The seven items that convey information inside the psycho-educational latent trait and makes reference to the following thematic cores are: V30 ability to identify one's own resources (0.91); V31 ability to carry out a project (0.88); V32 ability to use one's own resources in sharing artistic work (0.85); V33 ability to negotiate (0.83); V34 ability to tolerate moments of waiting and the rules of the setting (0.54); V 35 ability to be independent from the support of the arts therapists (0.79); V36 ability to evaluate one's own change (0.88). In this subscale, the items describe the subject's ability to identify and use their own skills and resources within the context of the laboratory.

Table 10 shows the descriptive statistics concerning this thematic area, whereas Table 11 shows the confirmatory factor analysis solution for the psycho-educational area. The linear structural model is show in Figure 4. The LISREL 8.8 syntax code has been included in the appendix E.

Tab. 11. Confirmatory factor Analysis (standardized solution) for the *Psycho-educational area*

Psycho-educational area	Psycho-education (FC$_1$)		
	λ^x	θ^d	R^2
V$_{30}$	**0.91**	0.16	0.84
V$_{31}$	**0.88**	0.23	0.77
V$_{32}$	**0.85**	0.27	0.73
V$_{33}$	**0.83**	0.31	0.69
V$_{34}$	0.54	0.71	0.29
V$_{35}$	0.79	0.38	0.62
V$_{36}$	**0.88**	0.23	0.77

Notes: Standardized solution for Fc$_1$: " Psycho-education"

As can be seen from the Table 11, the most fragile item is the one relating to the question V34 ("Ability to tolerate moments of waiting and the rules of the setting"). This evidence suggests that operators must pay attention to the patients' expressions to evaluate the level of tolerance during laboratory activities.
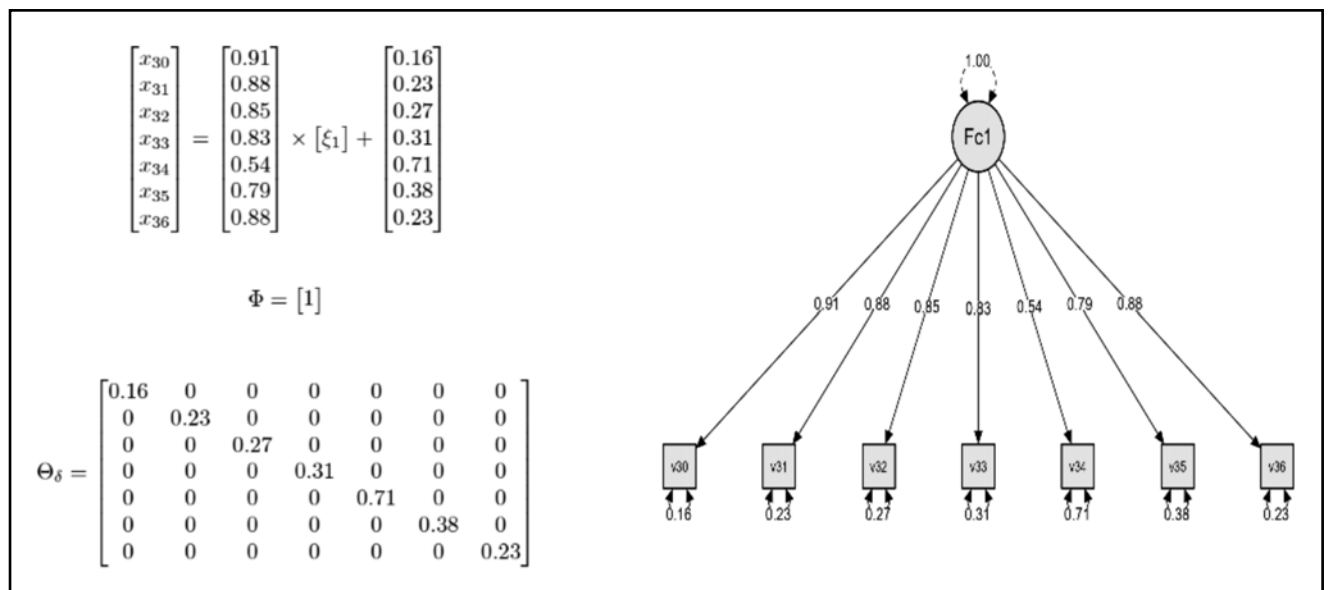
Fig. 4. Linear structural model for the *Psycho-educational area*

Tab. 12. Standardized Goodness of fit indices for the *Psycho-educational area*

Goodness of fit indices	CFI[1]	NFI[2]	PNFI[3]	RMSEA[4]	GFI[5]	SRMR[6]
Psycho-educational area	0.96	0.93	0.62	0.13	0.98	0.04

Notes: (1) Comparative Fit Index; (2) Normed Fit Index; (3) Parsimony Normed Fit Index; (4) Root Mean Square Error of Approximation; (5) Goodness of Fit Index; (6) Standardized root mean square residual

Table 12 has been reported the canonical goodness of fit indices for this latent trait.

Dimensionality analysis: Global component
Table 13 show descriptive statistics. This area is characterized by the presence of three specific evaluation sub-components: a first trait refers to the ability of the treated patients to cooperate socially during ATs activities. A second dimension refers to the ability to follow ATs activities with commitment and constancy. Finally, the third is related to emotional control in a social context (Table 14).

The first latent trait is named "Social involvement" and is internally composed of the questions V38 emotional participation; V39 creativity; V42 proactive skills; V44 ability to connect with everyday elements outside the laboratory; V48 ability to share personal interests; V49 agency; V50 changes in posture, proxemics and motricity (…). For this sub-dimension the most relevant items are V49, V39, V44: respectively with λ_x equal to (0.90, 0.89, 0.87). The second latent trait identifies the sub-dimension briefly named "Degree of participation". The internal composition of this latent trait is made up of items such as: V37 involvement; V40 enthusiasm; V41 interest; V46 ability

Tab. 13. Descriptive statistics for the *Global area*

Descriptives	v37	v38	v39	v40	v41	v42	v43	v44	v45	v46	v47	v48	v49	v50
Mode[1]	5.00	5.00	3.00	3.00	4.00	4.00	3.00	2.00	6.00	4.00	4.00	5.00	3.00	4.00
Median	5.00	4.00	3.00	4.00	4.00	4.00	3.00	3.00	5.00	4.00	4.00	4.00	4.00	3.00
Mean	4.40	4.03	3.54	3.86	4.16	3.58	3.66	3.43	4.78	4.15	4.05	4.15	3.59	3.30
Std. Deviation	1.26	1.38	1.40	1.41	1.40	1.39	1.14	1.65	1.24	1.30	1.26	1.36	1.45	1.51
Minimum	0.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00
Maximum	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00

Notes: (1) More than one mode exists, only the first is reported

Tab. 14. Confirmatory factor Analysis (standardized solution) for the *Global area*

Global area	Social involvement (FC$_1$)		Degree of participation (FC$_2$)		Self-regulation (FC$_3$)		R^2
	λ^x	θ^d	λ^x	θ^d	λ^x	θ^d	
V$_{38}$	0.85	0.27	-	-	-	-	0.73
V$_{39}$	**0.89**	0.21	-	-	-	-	0.79
V$_{42}$	0.85	0.28	-	-	-	-	0.72
V$_{44}$	**0.87**	0.25	-	-	-	-	0.75
V$_{48}$	0.83	0.31	-	-	-	-	0.69
V$_{49}$	**0.90**	0.19	-	-	-	-	0.81
V$_{50}$	0.55	0.70	-	-	-	-	0.30
V$_{37}$	-	-	**0.88**	0.23	-	-	0.77
V$_{40}$	-	-	0.85	0.28	-	-	0.72
V$_{41}$	-	-	**0.92**	0.14	-	-	0.86
V$_{46}$	-	-	0.74	0.45	-	-	0.55
V$_{43}$	-	-	-	-	0.81	0.34	0.66
V$_{45}$	-	-	-	-	0.47	0.78	0.22
V$_{47}$	-	-	-	-	**0.87**	0.25	0.75

Notes: Standardized solution for Fc1: " social involvement", Fc2: "emotional participation" and Fc3: "work setting adequacy"
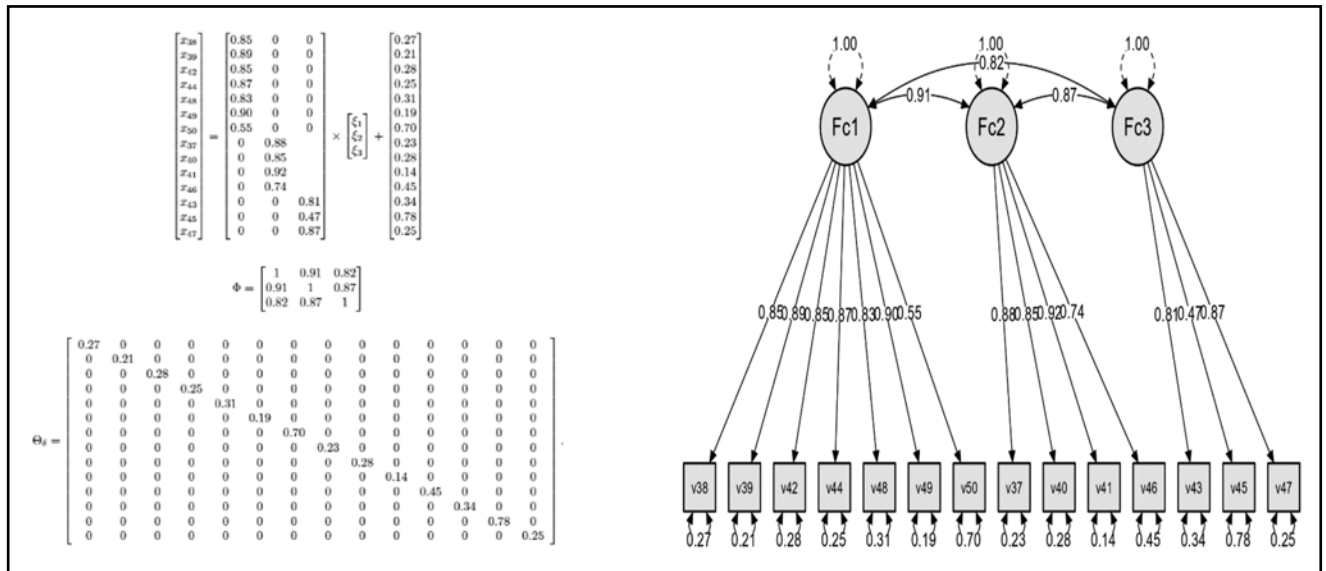
Fig. 5. Linear structural model for the *Global area*

Tab. 15. Standardized Goodness of fit indices for the *Global area*

Goodness of fit indices	CFI[1]	NFI[2]	PNFI[3]	RMSEA[4]	GFI[5]	SRMR[6]
Global area	0.94	0.89	0.72	0.10	0.96	0.05

Notes: (1) Comparative Fit Index; (2) Normed Fit Index; (3) Parsimony Normed Fit Index; (4) Root Mean Square Error of Approximation; (5) Goodness of Fit Index; (6) Standardized root mean square residual

Tab. 16. Descriptive statistics for the *Climate area*

Descriptives	v51	v52	v52	v54	v55	v56	v57	v58
Mode	4.00	1.00	5.00	2.00	5.00	4.00	1.00	1.00
Median	4.00	1.00	5.00	2.00	5.00	4.00	1.00	1.00
Mean	4.05	1.47	4.42	1.74	4.67	4.05	1.57	1.17
Std. Deviation	1.55	0.76	1.13	0.86	1.07	1.22	0.70	0.49
Minimum	0.00	0.00	0.00	0.00	2.00	1.00	1.00	1.00
Maximum	6.00	3.00	6.00	5.00	6.00	6.00	4.00	3.00

to verbalize what one thinks and feels. The third latent trait named "Self-regulation" constitutes the central core of emotional behaviour and its expected control. In order of relevance, the variables that saturate this latent trait are: V47 ability to understand the consequences of one's own actions in the context in which one finds oneself", V43 ability to tolerate frustration, V45 continuity in the attendance of meetings.

As can be seen from Figure 5, all three latent factors are highly positively correlated with each other. The highest correlation is found between the first and second factor corresponding to the latent traits "social involvement" and "degree of participation" (r = 0.91), otherwise the correlations between "social involvement" and "Self-regulation" (r = 0.82) as well as between "degree of participation" and "self-regulation" (r = 0.87) appear slightly toned down.

For this area, the goodness-of-fit indices are reasonably reliable (see Table 15), showing a good fit of the three-factor model to the data. The LISREL 8.8 syntax

code has been included in the appendix F to obtain the output of the analysis.

Dimensionality analysis: Climate component
The climate area intends to investigate the quality of emotional participation that patients show during laboratory activities. Table 16 shows descriptive statistics. This area provides for an assessment of emotional behavior in both the positive and negative spheres (Table 17). This dimension is therefore splittable into two opposing spheres: the "positive dimension" for which the reference items are: V51 Was there a positive change in mood at the end of the meeting compared to the beginning?; V53 Degree of wellbeing in the laboratory; V55 Context-appropriate behaviour; V56 Positive comments. Instead, the items characterizing the "negative dimension" are: V52 Was there a negative change in mood at the end of the meeting compared to the beginning; V54 Degree of discomfort in the laboratory; V57 Devaluing comments; V58 Aggressive/

Tab. 17. Confirmatory factor Analysis (standardized solution) for the *Climate area*

Climate area	Assessment of emotional behavior - positive (FC$_1$)		Assessment of emotional behavior - negative (FC$_2$)		
	λ^x	θ^d	λ^x	θ^d	R^2
V$_{51}$	0.64	0.59	-	-	0.41
V$_{53}$	**0.84**	0.30	-	-	0.70
V$_{55}$	0.70	0.51	-	-	0.49
V$_{56}$	**0.85**	0.28	-	-	0.72
V$_{52}$	-	-	0.63	0.60	0.40
V$_{54}$	-	-	**0.75**	0.44	0.56
V$_{57}$	-	-	0.66	0.56	0.44
V$_{58}$	-	-	0.54	0.71	0.29

Notes: Standardized solution for Fc1: " Assessment of emotional behavior - positive " and Fc2: " Assessment of emotional behavior - negative "
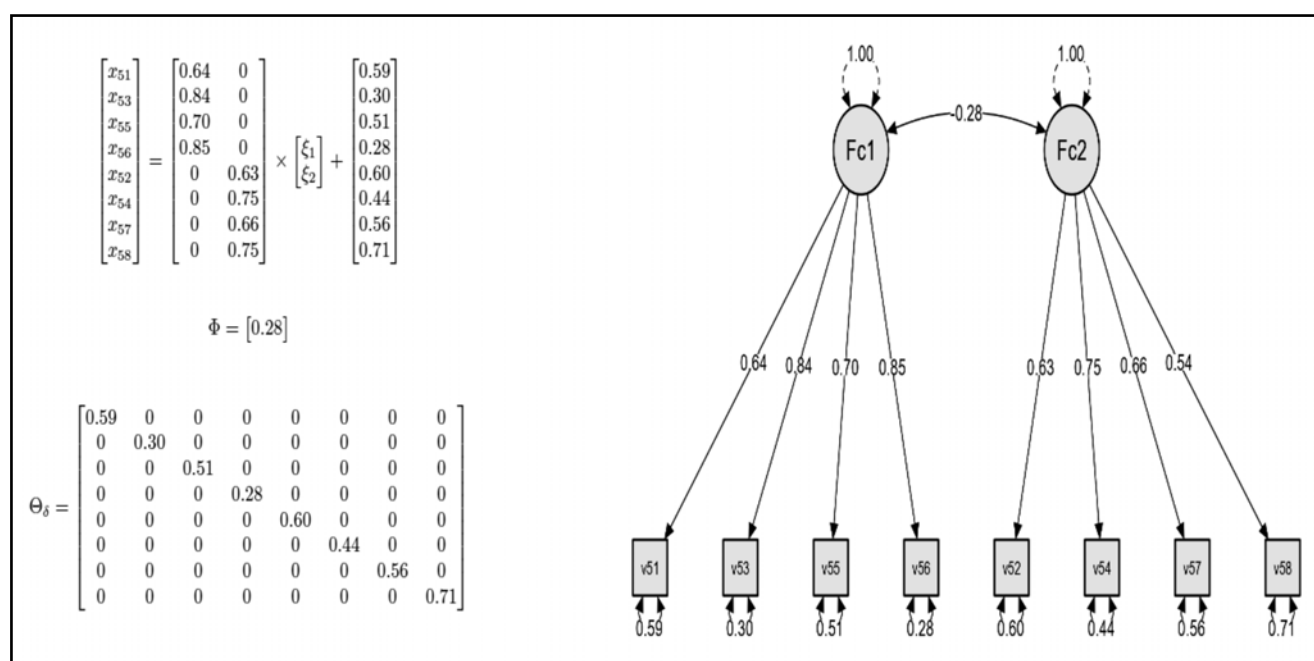
Fig. 6. Linear structural model for the *Climate area*

Tab. 18. Standardized Goodness of fit indices for the *Climate area*

Goodness of fit indices	CFI[1]	NFI[2]	PNFI[3]	RMSEA[4]	GFI[5]	SRMR[6]
Climate area	0.90	0.85	0.58	0.12	0.99	0.006

Notes: (1) Comparative Fit Index; (2) Normed Fit Index; (3) Parsimony Normed Fit Index; (4) Root Mean Square Error of Approximation; (5) Goodness of Fit Index; (6) Standardized root mean square residual

destructive comments. It should be observed that the correlation between the two subdimensions is negligible (r = -0.28) and this fact indicates that the level of recognition and separability of the emotions shown by the patients in the laboratory activity sections play an important role in planning any future activities on the same set of patients (see the factorial correlation structure shown in Figure 6). Table 18 shows the main goodness of fit indices for this theoretical dimension.

The LISREL 8.8 syntax code has been included in the appendix G.

DISCUSSION

The aim of the present study was to develop and validate the SMPA to evaluate the clinical effectiveness of ATs in psychiatry, transversally suitable for each ATs.

The size of the sample used (N = 101) guarantees an adequate level of confidence in the estimated statistical parameters, regardless of the distributional form expected for this type of information.

All ATs have specific factors inherent to artistic making; in particular, the transformation process implies a change that includes cognitive, affective, relational, behavioral, expressive aspects, in parallel with the improvement or despite the stationarity of the ongoing pathology (Attard & Larkin 2016; Viganò *et al.* 2019; Melorio, 2019).

The available AT outcome assessment tools are different and do not always investigate the dimensions considered in our work (Chiang *et al.* 2019; Carr *et al.* 2021; De Witte *et al.* 2021). SMPA overcomes this limitation as it is a tool capable of assessing the various dimensions relevant to art therapy that are not fully captured by the available clinical diagnostic tools.

Considering the above, SMPA taking into account the common dimensions, can be a useful tool for evaluating the outcomes of all ATS.

The SMPA is combined with a manual that contains a detailed explanation of all the items so that the scale can be interpreted and filled in a homogeneous manner by all arts therapists. Other positive features are the ease of use by arts therapists working in Mental Health Services and the possibility to discuss clinical results for well-defined areas.

Conclusions

To our knowledge, no previous study has developed a unified scale to describe patient change from different disciplines.

The SMPA was conceived as a tool for evaluating changes in the AT activities of each patient over time. In clinical practice with patients suffering from major psychiatric pathologies, SMPA can provide data to be used by all members of the team involved in the treatment using a shared language.

The results of the statistical analysis suggest that the SMPA is a valid tool for the evaluation of all ATs involving patients with different psychiatric diagnoses in different therapeutic contexts.

Finally, in specific research protocols it can be correlated with the results of other tests (for example, neuropsychological, diagnostic, and so on).

A potential limitation is given by the choice to select a sample in which different characteristics are mixed (age, sex, diagnosis, etc.). Anyway, our aim was to validate the SMPA in real-world context, for use in usual clinical settings where the population attending AT laboratories is mixed. Consistently all subjects involved in the study were eligible. Evaluating SMPA in a real-world setting allows to verify the effectiveness of the treatments usually applied.

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Appendix A

SMPA Scheda di Monitoraggio del Percorso nelle Arti terapie (Arts Therapies Monitoring Scale)

Cognitive area
V1 Presence to oneself, awareness of the here and now
V2 Attention span
V3 Ability to focus
V4 Comprehension skills
V5 Non-verbal communication skills
V6 Abstract thinking skills
V7 Route memory capacity
V8 Ability to maintain work continuity during activities
V9 Ability to recognize one's own product
V10 Ability to select
V11 Emotional understanding skills

Relational area
V12 Ability to relate to the art therapist
V13 Ability to relate to the group
V14 Ability to maintain balance between taking time and occupying space and leaving time and space for others
V15 Ability to trust other people
V16 Ability to take care of space and materials
V17 Ability to comply with schedules and rules
V18 Ability to relate to materials and artistic means
V19 Ability and willingness to share one's own artistic product

Expressive area
V20 Creative ability
V21 Ability to use one's own resources
V22 Ability to express one's own desires and wishes
V23 Ability to vary the expressive contents
V24 Ability to face artistic unexpected events and find new solutions
V25 Ability to express satisfaction with the finished product
V26 Ability to devote adequate time to artistic creation
V27 Ability to choose
V28 Ability to modify the technique in relation to one's creative desire
V29 Ability to use non-verbal language

Psycho-educational area
V30 Ability to identify one's own resources
V31 Ability to carry out a project
V32 Ability to use one's own resources in sharing artistic work
V33 Ability to negotiate
V34 Ability to tolerate moments of waiting and the rules of the setting
V35 Ability to be independent from the support of the art therapist
V36 Ability to evaluate one's own change

Global Evaluation
V37 Involvement
V38 Emotional participation
V39 Creativity
V40 Enthusiasm
V41 Interest
V42 Proactive skills
V43 Ability to tolerate frustration
V44 Ability to connect with everyday elements outside the laboratory
V45 Continuity in the attendance of meetings
V46 Ability to verbalize what one thinks and feels
V47 Ability to understand the consequences of one's own actions in the context in which one finds oneself
V48 Ability to share personal interests
V49 Agency
V50 Changes in posture, proxemics and motricity in relation to:
a. relational dynamics
b. global approach to the laboratory work setting

Climate
V51 Was there a positive change in mood at the end of the meeting compared to the beginning?
V52 Was there a negative change in mood at the end of the meeting compared to the beginning?
V53 Degree of wellbeing in the laboratory
V54 Degree of discomfort in the laboratory
V55 Context-appropriate behavior
V56 Positive comments
V57 Devaluing comments
V58 Aggressive/destructive comments

Appendix B

LISREL 8.8 syntax to run the maximum likelihood confirmatory factor analysis for the cognitive area (see figure 1 in the main manuscript).

```
DA NI=11 NO=101 MA=CM
LA
V4 V5 V6 V7 V10 V11 V12 V1 V2 V3 V8
CM
1.59
1.28 1.89
1.53 1.51 2.29
1.30 1.29 1.53 1.88
1.17 1.15 1.37 1.17 1.54
1.35 1.33 1.59 1.35 1.21 1.95
1.20 1.18 1.41 1.20 1.08 1.24 1.63
1.09 1.08 1.29 1.10 0.98 1.14 1.01 1.52
1.17 1.16 1.38 1.18 1.06 1.22 1.08 1.22 1.42
1.13 1.11 1.33 1.13 1.02 1.17 1.04 1.18 1.26 1.45
0.99 0.97 1.16 0.99 0.89 1.03 0.91 1.03 1.10 1.06 1.57
SE
1 2 3 4 5 6 7 8 9 10 11/
MO NX=11 NK=2 TD=SY ,FI PH=FU,FR
LK
Fc1 Fc2

PA LX
1 0
1 0
1 0
1 0
1 0
1 0
1 0
0 1
0 1
0 1
0 1

FR TD(1,1) TD(2,2) TD (3,3) TD(4,4) TD(5,5) TD(6,6) TD(7,7) TD(8,8) TD(9,9) TD(10,10) TD(11,11)
PD
OU SC
```

Appendix C

LISREL 8.8 syntax to run the maximum likelihood confirmatory factor analysis for the relational area (see figure 2 in the main manuscript).

```
DA NI=8 NO=101 MA=CM
LA
V12 V13 V16 V17 V18 V19 V14 V15
CM
1.63
0.99 1.28
0.95 1.05 1.81
0.72 0.79 0.76 1.70
0.58 0.64 0.61 0.92 1.81
0.74 0.82 0.78 1.17 0.95 1.91
0.42 0.47 0.45 0.57 0.46 0.58 2.91
0.68 0.75 0.72 0.92 0.74 0.94 1.41 2.57
SE
1 2 3 4 5 6 7 8 /
MO NX=8 NK=3 TD=SY ,FI PH=FU,FR
LK
Fc1 Fc2 Fc3
PA LX
1 0 0
1 0 0
1 0 0
0 1 0
0 1 0
0 1 0
0 0 1
0 0 1

FR TD(1,1) TD(2,2) TD (3,3) TD(4,4) TD(5,5) TD(6,6) TD(7,7) TD(8,8)
PD
OU SC
```

APPENDIX D

LISREL 8.8 syntax to run the maximum likelihood confirmatory factor analysis for the expression and creativity area (see figure 3 in the main manuscript).

```
DA NI=10 NO=101 MA=CM
LA
V20 V21 V22 V23 V24 V25 V26 V27 V28 V29
CM
1.87
1.38 1.49
1.44 1.24 1.70
1.42 1.23 1.28 1.65
1.39 1.21 1.26 1.25 1.56
0.99 0.86 0.90 0.89 0.87 1.64
1.26 1.09 1.13 1.12 1.10 0.78 1.75
1.65 1.43 1.49 1.47 1.45 1.03 1.30 2.29
1.54 1.34 1.39 1.38 1.35 0.96 1.22 1.60 2.15
1.07 0.93 0.97 0.96 0.94 0.67 0.85 1.11 1.04 2.43
SE
1 2 3 4 5 6 7 8 9 10/
MO NX=10 NK=1 TD=SY ,FI
LK
Fc1
PA LX
1
1
1
1
1
1
1
1
1
1

FR TD(1,1) TD(2,2) TD (3,3) TD(4,4) TD(5,5) TD(6,6) TD(7,7) TD(8,8) TD(9,9) TD(10,10)
PD
OU SC
```

APPENDIX E

LISREL 8.8 syntax to run the maximum likelihood confirmatory factor analysis for the psycho-educational area (see figure 4 in the main manuscript).

```
DA NI=7 NO=101 MA=CM
LA
V30 V31 V32 V33 V34 V35 V36
CM
1.68
1.56 2.27
1.33 1.48 1.73
1.16 1.29 1.10 1.38
0.77 0.85 0.73 0.63 1.44
1.42 1.58 1.34 1.17 0.78 2.30
1.39 1.54 1.32 1.14 0.76 1.40 1.79
SE
1 2 3 4 5 6 7/
MO NX=7 NK=1 TD=SY ,FI
LK
Fc1
PA LX
1
1
1
1
1
1
1

FR TD(1,1) TD(2,2) TD (3,3) TD(4,4) TD(5,5) TD(6,6) TD(7,7)
PD
OU SC
```

APPENDIX F

LISREL 8.8 syntax to run the maximum likelihood confirmatory factor analysis for the global area (see figure 5 in the main manuscript).

```
DA NI=14 NO=101 MA=CM
LA
V38 V39 V42 V44 V48 V49 V50 V37 V40 V41 V46 V43 V45 V47
CM
1.89
1.45 1.95
1.38 1.45 1.91
1.66 1.75 1.66 2.68
1.32 1.39 1.31 1.59 1.83
1.53 1.61 1.53 1.84 1.46 2.08
0.97 1.02 0.97 1.17 0.93 1.08 2.25
1.18 1.24 1.17 1.42 1.12 1.30 0.83 1.57
1.27 1.34 1.27 1.53 1.21 1.41 0.89 1.31 1.98
1.37 1.45 1.37 1.66 1.31 1.52 0.97 1.42 1.53 1.94
1.02 1.08 1.02 1.23 0.98 1.13 0.72 1.05 1.14 1.23 1.67
0.89 0.93 0.88 1.07 0.85 0.98 0.62 0.89 0.96 1.04 0.77 1.29
0.56 0.59 0.56 0.67 0.53 0.62 0.39 0.56 0.60 0.65 0.48 0.54 1.52
1.04 1.10 1.04 1.26 1.00 1.16 0.73 1.04 1.13 1.22 0.91 1.00 0.63 1.57
SE
1 2 3 4 5 6 7 8 9 10 11 12 13 14/
MO NX=14 NK=3 TD=SY ,FI PH=FU,FR
LK
Fc1 Fc2 Fc3
PA LX
1 0 0
1 0 0
1 0 0
1 0 0
1 0 0
1 0 0
1 0 0
0 1 0
0 1 0
0 1 0
0 1 0
0 0 1
0 0 1
0 0 1
FR TD(1,1) TD(2,2) TD (3,3) TD(4,4) TD(5,5) TD(6,6) TD(7,7) TD(8,8) TD(9,9) TD(10,10) TD (11,11) TD(12,12)
TD(13,13) TD(14,14)
PD
OU SC
```

Appendix G

LISREL 8.8 syntax to run the maximum likelihood confirmatory factor analysis for the climate area (see figure 6 in the main manuscript).

```
DA NI=8 NO=101 MA=CM
LA
V51 V53 V55 V56 V52 V54 V57 V58
CM
2.36
0.94 1.27
0.74 0.71 1.13
1.02 0.97 0.77 1.47
-0.13 -0.13 -0.10 -0.14 0.57
-0.18 -0.17 -0.13 -0.18 0.30 0.73
-0.13 -0.12 -0.10 -0.13 0.22 0.29 0.48
-0.07 -0.07 -0.06 -0.08 0.13 0.17 0.12 0.24
SE
1 2 3 4 5 6 7 8/
MO NX=8 NK=2 TD=SY ,FI PH=FU,FR
LK
Fc1 Fc2

PA LX
1 0
1 0
1 0
1 0
0 1
0 1
0 1
0 1

FR TD(1,1) TD(2,2) TD (3,3) TD(4,4) TD(5,5) TD(6,6) TD(7,7) TD(8,8)
PD
OU SC
```