

# Test Validation Process of Tactical Knowledge in Tennis: the Influence of Practice Time and Competitive Experience

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**Abstract** This paper describes the development process to test validation of declarative tactical knowledge in tennis since the scenes definition to the items validation up to the application of pilot test. Based on the theory of the latent trait the psychometric requirements searching for the validation of the constructs perception and decision making, were properly respected. Was reached to satisfactory values of content validity (0.89), reliability with  $\alpha=0,6518$  and difficulty items index. After the test application there was a significant correlation between the perception and decision making ( $r=0,612$ ). Were found evidences of practice time and participation in competitions in higher levels influences in improvement of the tactical knowledge level of young tennis players.

**Keywords** Test Validation, Declarative Tactical Knowledge, Tennis

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## 1. Introduction

In Sports Science there is a growing necessity of using valid instruments which allow to measure and evaluate behaviors, for instance, tactical and technical performed by athletes in different sports. A methodological alternative for the construction of these tools comes from Psychology and it is entitled Psychometry.

From the 1980s were developed empirical works in the area of tactical abilities. The aim with these results is to create opportunities in improvement of the sports training processes. In this line of research construct as working memory, attention, decision making, as well as, other cognitive processes are themes which still need a better comprehension in relation to its influence in athlete's tactical action[1-5].

In validation test of declarative tactical knowledge in tennis (TDTK:TN), was taken as a theoretical reference a model suggested by Pasquali,[6-8], this research was directed by necessary procedures to theoretical validation, through the explicitation of latent trait theory and construction phases of the items.

Based on the research from Costa et al.[9], and complementing up to the 2012 was observed in the last 15

years only three researches were performed presenting as focus the perception processes and decision making in tennis[1],[10],[11]. It is important to emphasize that researches previously cited lack reference to adopted procedures to its validation. The technique applied consisted in interviews and slides presentation. Therefore, in these researches, the game situation presented to the athletes was frozen, without player's motion, which was questioned by other authors[12-14]. The papers of three authors cited above focused tennis perception and anticipation, and showed that training cognitive processes, through video simulation, helped to development of tactical training in the field.

Two more studies presented instruments developed to assess the tactical knowledge, but the Game test situations[15] that assess the person in action, not presenting good results to the tennis practioners, but to volleyball[16]. The Game Performance Assessment[17] was already applied in racquet sports researches such as badminton and pickleball[18], but it does not contain the necessary specificity to assess the tactical-technical action that occur in tennis, which decreases the action's evaluation validity by collecting through these instruments.

In order to approximate the presentation way of the inducement about how they occur in reality[19],[20], through technological video resources, real games scenes were collected for the next validation process by a panel of judge's coaches. Thus, in this study, video images games were digitalized, allowing the participant analyze all the temporal sequence, to opportunely choose the best decision to be taken in point setting situation.

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In sports, assessment of declarative tactical knowledge (DTK) enables to understand through of what the player says its way and level of tactical comprehension of the game. Thus, explaining what will be done according to its game logic, the structures and goals which is determined by itself, it is possible to organize teaching -learning processes which leads the athletes training.

The problems solution and decision making in sports are relied on interrelation between knowledge, particularly in the influence of working memory, and the different cognitive processes which consist in defining the tactical behavior[21-23]. Greco[24] points out those informations, both in its own organism as the game environment which leads to decisions and actions fulfillment, are considered in three structures: perceptual, information process and decision which occurs in parallel, mutually inter-related. In perceptual structures occurs the information reception which results through triad functions in the perception-anticipation-attention processes.

In the perceptive information structure it is interfered the ways of thinking about divergent and convergent[25] and intelligence interaction resulting from the decision and coding of all the information, creating opportunity to consolidate of what and how to do[26]. An appropriate information selection, for instance, the perception of the opponent's displacement, the height of bouncing and the ball effect allows the player to be aware in meaningful details of the game, providing contributions to an appropriate decision making[27],[28].

The cognitive processes underlying to decision making are deeply related to tactical comprehension and the way an athlete plans the game, and can be analyzed based on the declarative tactical knowledge levels (DTK) and procedural tactical knowledge (PTK)[1],[5],[29]. The DTK evaluation allows to interpret, through players declaration about comprehension level of tactical decisions, the issues realized to make a decision and the success conditions that would have in executing different skills in a specific game situation[30],[31]. Yet, PTK reveals itself when an athlete performs effectively actions in different situations, relying on an achievement of a technique[32],[33]. Thus, "know what" (DTK) is related to "know to do" (PTK). Researches has been pointed out the as the experiences level during years of practice increase, DTK has been transformed into PTK[5],[34-36].

In an extensive review[37] were presented the protocol analysis using verbalized thought to check how the cognitive processes act to solve problems. This analysis has emerged as a practical tool to diagnose the thinking outside the traditional cognitive psychology. This study was based on this methodological tool. When asked to decide about a game situation the subjects expressed their decision make "thinking aloud". Moreover, the same author states that the explanation of the answer, in this study expressed by perceptual signals in game situation improves comprehension, memory and learning.

In other words procedures that entail describing or

explaining thoughts and actions are significantly reactive, leading to higher performance than silent control conditions, leading to higher performance than silent control conditions[38].

The computerized assessment points out advantages such as the immediate result of the construct by the subject, presenting its decision making, as well as the perceptual signs of greater relevance. Moreover, it can be applied both individually through notebook as in group in a location with image projector and adequate lighting. As a complement of DTK computerized assessment is necessary to assess the subject in action, in order to check through motor-cognitive actions PTK level. Besides, this test assesses the decision making and perception in the baseline game. Further tests need to be developed to involve other tactical-technical actions in tennis.

The creation of TDTK:TN based on psychometric principles admit its pedagogical application to sports and physical education provides contribution to direct the tennis players teaching-learning processes. The more is known about the athlete's behavior in sports, the condition to elaborate teaching-learning processes are better, and points out to development of its potentials on several abilities related to sports productivity.

Empirical researches about DTK and PTK in tennis[1],[10-12],[28],[32],[35-39], analyzed the factors which interfere in cognitive processes, for instance, age, accounted experience in practice time, experience in competitions and effective training which use motor skills acquisition.

The step one of the research had its aim focused on the identification in action's frequency technical-tactical the most executed in simple tennis games (1x1). Deciding this criteria, was edited 192 action scenes from males games in point setting situation. Besides, was verified a disagreement among the actions in slow and fast floors, which could define the technical-tactical action's features in point setting situation.

Thus, was resulted a total of 92 baseline definitions actions; the next step was built in validation items to the creation of TDTK;TN thought a content validity.

The step three aimed items selection in TDTK:TN level through reliability by objectivity. Finally, after the pilot test application, the step four showed the reliability by reproducibility and difficulty index of the items. This index shows the difficulty level of the question to be answered by the evaluated, which cannot be very easy or extremely difficult in such way that the evaluated cannot answer[7]. After these four steps, the instrument showed the validity and reliability, essential aspects to tests validation.

The methodology and results items will be presented in a subdivided way according to each step that represent the research goals necessary to TDTK:TN validation.

## 2. Methodology

### 2.1. Sample

Step 1: The sample constituted of the compilation in 192 video scenes in 32 male tennis players' professionals games collected among 2002-2007 years, in sports courts of slow and fast floor. Although the psychometry suggest three times of the items to discard when it is not constituted from a theory, in function of the clarity criteria in the images of theoretical validation and the lack of validation of the constructs perception and decision making, the initial number of items was four times of the necessary. In this case, the items were computed from 92 scenes most frequent in sports court.

Step 2: A panel of five judges compounds the sample of the content validation. According to [40], in these selection criteria these people would not participate previously of any part of the process of this research. Besides, could be counted with the active experience at least of 10 years in this area. A third criteria included it was that judges should be tennis coaches who directed young athletes in the 10<sup>th</sup> first in ranking positions situated in state or national circuit, or who had trained its players which had competed in an international scenario.

Step 3: The opinion of five judges was still used to continue the TDTK:TN validation process about 39 items remained, after content validity coefficient (CVC) in order to show the reliability instrument.

Step 4: Differentiated by sample plan not probabilistic by convenience [41], the sample depended on research features pointed, divided into a total of 111 young tennis players (16,24±5,09), male, state and/or national competitors. It is important to emphasize that a tennis player can constitute two different groups, because during his sports career, competed in tournaments in different competition level. The participation number in each competitive level (never competed, in 1 to 10 competitions and from 11 competitions on) and practice time used into groups (from 1 to 6 years and 11 months and from 7 years on) were based on the research [33].

**2.2. Procedures**

Step 1: After the edition using Virtual Dobe e Windows Movie Maker softwares, the game video scenes went through an investigation in order to define the agreement levels [42], assert that consistency must be above 0.80 to make the scenes achieve satisfactory reliability by reproducibility levels.

Step 2: To the content validation in scenes were followed the presented procedures by Hernández-Nieto [43] in criteria like: image clarity, practice relevance and item representation, knowing that only agreement values ≥ 0,8 among judges were considered.

Step 3: The remained items went through discard process by reliability throughout objectivity up to the final counting of validated items in theoretical analysis.

Step 4: The TDTK:TN application occurred during periods in tennis players training. The practical experience and experience in competitions were asked to the

participants during data collection. In these procedures was presented game video scenes (test items). The participant spends 3 seconds to observe the frozen scene after the conclusion, and afterwards appears a black screen; and after it is his time to express his answer [decision making (what to do?) and perception in relevant signals (why to do? namely what did the participant observe)] in a declarative way (e.g. Figure 1).



**Figure 1.** Participant perspective visualizing TDTK:TN scenes

The participants' answers were regarded in a scale of three possible hits these ones were appreciated by quartiles punctuations of: 10, 6 e 3 points, from the most correct answer to the less one. The relevant signals were detected from the perception of fixed objects (A) and its sub items as block lines, net, etc. and moving objects (B) divided also in sub items as: player's decisive side space and opponent player's side space, etc. (e.g. Table 1).

**Table 1.** Exemplified template in decision making and relevant signals recognized in these scenes

Item	Scene	Decision	Point	Relevant Signals		
42	1	DC 9	10	B2 (4)	B3 (4)	B1 (2)
42	1	DC 6	6	B3 (4)	B1 (4)	B2 (2)
42	1	DP 7	3	B2 (4)	B5 (6)	
39	2	DC 6	10	B3 (5)	B2 (5)	
39	2	DC 9	6	B3 (2)	B2 (6)	B1 (2)
39	2	DP 7	3	A2 (2,5)	B1(2,5)	B5 (2,5)
...	3	...	...	...	...	...
...	3	...	...	...	...	...

The template were formulated from the agreement among the observes above 0.80 and the ecological validity in what really had happened in the game scene and the judge's answer. The participant must choose the answer checking the blow direction to be chosen and the place in the opponent court where the ball must reach (e.g. Figure 2).

Scene	What to do? Choose only on option.	Where? Check an X in one of the places enumerated in the sports courts.									
1											
RIGHT PARALLEL ( )		<table border="1"> <tr><td>9</td><td>8</td><td>7</td></tr> <tr><td>X</td><td>6</td><td>4</td></tr> <tr><td>3</td><td>2</td><td>1</td></tr> </table>	9	8	7	X	6	4	3	2	1
9	8	7									
X	6	4									
3	2	1									
RIGHT CROSS ( X )											

**Figure 2.** Illustration of the answer filling form

After this moment, the participant must justify his decision explaining the relevant signals which he recognizes in the video scene. These signals were settled from a thematic analysis of the expert’s answers to the perception in each scene, in 03 decisions (the most correct answer to less correct one) were classified according to[44] (e.g. Table 2).

**Table 2.** Relevant signals categories[45]

A: Fixed objects (25 relevant signals)
A1: Court lines A2: Net A3: Type of floor A4: Scoreboard up to the game moment
B: Moving objects (764 relevant signals)
B1: Decisive player side space B2: Opponent player side space - distance from the ball B3: Side opponent space –distance from lines and net B4: Ball time B5: Movement in time

**2.3. Data Analyses**

Step 1: Was applied the Halves and Spearman Brown Prognostics Technique to the agreement analysis intra-rater; the kappa test was used to find the agreement observed among the experts[42], thus, defining the scenes reliability by reproducibility. The chi square test verified a disagreement among the observed and expected results, of frequencies obtained from technical-tactical actions types by tennis players concerning two floor types. The significance level adopted was  $p \leq 0,01$ .

Step 2: The content validation coefficient by Hernández-Nieto[43], presents (e.g. equation) and it is possible to evaluate the degree in which items represent the constructs through intentional actions.

$$M_x = \sum x / J \tag{1}$$

Average of each item: Sum of the obtained numbers in likert scale (x) by the judges number (J);

$$CVCi = M_x / V_{max} \tag{2}$$

CVC’s item: average item by the maximum number the item can reach;

$$CVCc = CVCi - (1/J)^J \tag{3}$$

CVCc: CVC’s item subtracted from the Constant (Pei) of the formula

$$CVCt = Mcvci - M(1/J)^J \tag{4}$$

Total CVC: CVC average of the subtracted item from the constant average.

CVCi-Content validity coefficient of each item

CVCc-Content validity coefficient of each item subtracted from the constant

Pei - Formula constant

CVCt - Content validity coefficient of total content criteria

Step 3: Was used the agreement procedure among the observes (CEO)[42]. It means that, was defined reliability by objectivity of judges decision making. At the moment to constitute as criteria, which are the better items to be chosen to take part of TDTK:TN to get to a complete consideration

of ecological validity were used only scene which presented agreement on the judges’ decision making when in fact occurred ( $> 0.80$ ). Besides, was proceed the content analysis by the thematic analysis technique to create a judges’ template to determine the best making decision and relevant signals used to evaluate perception in each item[46].

Step 4: After the TDTK:TN application in young tennis players, the difficulty index items was obtained by the reason (p) between the frequency item hits and the amount of sample evaluated[8] and the inter-class correlation coefficient (ICC) was pointed to verify through Kolmogorov-Smirnov test. Was used a descriptive average analysis and standard deviation, as well as the tests usage: Anova of two factors, Anova of one test verification factor of Levene and post hoc of Bonferroni, and at last, the Pearson correlation[47]. The meaningful level adopted was  $p \leq 0,05$ .

**3. Results**

For a better didactic-methodological comprehension the results will be shown according to methodological steps of validation. The step 1 is related to items in operational system, and steps 2, 3 and 4 are part of the item analysis until the construction and application of the main instrument[6], [7].

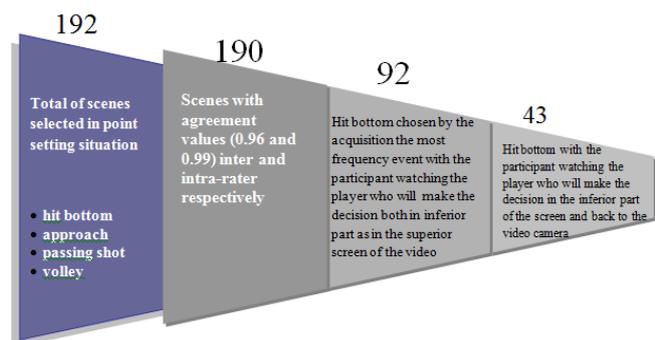
Step 1: After the descriptive data analysis (e.g. table 3), the absolute frequencies of technical- tactical actions presented an agreement level 0.96 intra-rater. Yet, the agreement inter-rater level obtained a number of 0.99. The results above confirmed 190 scenes with high agreement numbers, excluding only two of 192 total scenes.

The action frequencies of baseline actions, volley, approach and passing shot, for both floor types, are different with  $X^2 56,51$  as well as, in the chi-square execution to each floor type (slow  $X^2 26,62$ ; fast  $X^2 31,56$ ) with  $p \leq 0,01$ . Were kept 92 scenes from the baseline for being higher frequency event, like this, keeping the possible scene roster to be validated[48].

**Table 3.** Total actions by floors types[48]

Actions	Floor type, absolute actions frequency and percentage by actions				Total actions	
	Slow		Fast			
	f	%	f	%	f	%
Hit bottom	33	17,3	59	31	92	48,4
Volley	8	4,2	21	11	29	15,2
Passing shots	11	5,8	20	10,5	31	16,3
Approach	10	5,2	28	14,7	18	20
Total	62	32,5	128	67,2	190	100

Nevertheless, in only 43 scenes from the baseline, the images presented the player who would make decision in the inferior part of the video, and would approximate the participant into the reality in the game situation, as if it was the decisive player[49] (e.g. Figure 3).



**Figure 3.** Discard scenes process in the items operationalization system[49]

Step 2: The results showed that 3 criteria of content validity coefficient, on its total numbers, obtained match mark of 0.83 of CVCt, including the relevance practical criteria (CVCt = 0,91), which settles that scenes represents appropriated situations to decision making in tennis game.

The item representation, it means, if the scenes allow the analysis of decision making and from perception reached 0.98 CVCt in all items, numbers considered high in content validity.

Finally, in the clarity image criteria, in relation to these present objects in game situation, such as: ball, players, net, block lines, in spite of having as result CVCt of 0.89, 4 items (5, 10, 12 and 35) obtained CVCc between 0.71 and 0.79, unacceptable numbers which were definitely discarded[50]. After CVC, the 39 remained items were kept in the TDTK:TN validation process.

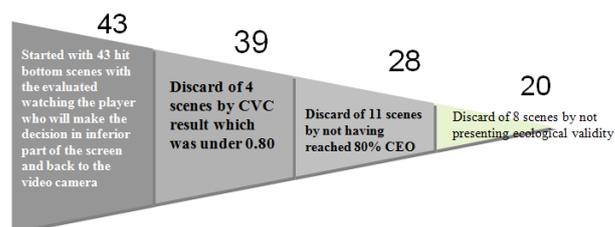
Step 3: At this moment, still based on the judge's opinion, was verified the items ability hypothesis to represent correctly the constructs decision making and tennis perception. Throughout a thematic analysis was reached the template conception of judges to decision making and perception.

The items relevance in relation to the construct which represented was obtained by the agreement among the observes (CEO) and points out the reliability by objectivity and by ecological validity. From 39 remained items, 12 items presented a CEO percentage to the best decision making of 100% in others 16 items CEO was 80% in 11 remained items, CEO found was 60%. Therefore, items that reached only 60% of CEO were discarded, keeping a total of 28 items.

Of the 28 remaining items was compared the judges' opinion with decision making when the tennis players indeed executed in game situations. Therefore, 20 items which composed TDTK:TN present ecological validity. The figure 4 describes the discard and final item counting process validated in a theoretical analysis from scenes selection of hit bottom in the video inferior part.

For this construct type, the known tests in literature that evaluates the tactical knowledge in Tennis, Basketball, Handball and Field Football, presents a minimum of 6 and maximum of 15 items, with this amount it is possible to evaluate this kind of construct[4],[48],[51-54]. Intending not to be an extended test in the application moment, and

respecting the criteria in above paragraph, 10 of the 20 items were chosen to compose the test, concerning about the decisions appreciation for both sides of the player's decisive body, just like, decisions using different technical actions (parallel and cross balls, long and short trajectories).



**Figure 4.** Discard scenes process in items analysis[49]

Step 4: Due to answer to the test items was divided in two questions which was added, to compose an unique number (decision making + justification through relevant noticed signals), after the application of the pilot test, was verified a positive and reduced correlation between perception or justification, and decision making ( $r = 0,612$ ;  $p \leq 0,000$ ) to all the TDTK:TN questions.

The difficulty index of 10 items was confirmed into the intended distribution as seen in the Graphic 1.



**Graphic 1.** Difficulty index of the TDTK:TN item

This claims that difficulty level of answers search through in levels, not even very difficult ( $< 0.10$ ) or easy ( $> 0.90$ ). The intraclass correlation coefficient (ICC) presented the number  $\alpha 0,6518$  ( $p=0,006$ ).

To verify the practice time influence and in the competition number in different levels about DTK, its resulting values were submitted to the normality test, and present as normal with  $p=0,083$ . Assuming that variances are equal such as in the competitive state level ( $p \leq 0,064$ ), as in national level ( $p \leq 0,136$ ), at the chart data 2, was observed in the state national level considering practice time up to 6 years, the higher DTK score was presented by athletes who participated in higher competition number. For the athletes from 7 years practice on, the higher DTK score was obtained by those who participated up to 10 competitions in this level.

When analyzed the national competitive level (table 4), with practice time up to 6 years the higher DTK score were reached by tennis players with participation up to 10 competitions. Among the athletes with practice time from 7

years, similar results of higher DTK score were also obtained 10 participations in competitions.

**Table 4.** Data description by competitive level and time practice

Competitive Level	Practice Time	Competition Number	$\bar{x}$	Sd
State	Up to 6 years	From 1 to 10	97,5	25,89
		Above 11	101,09	22,31
	From 7 years	From 1 to 10	121,00	12,30
		Above 11	109,72	18,72
National	Up to 6 years	From 1 to 10	107,87	26,39
		Above 11	101,43	17,37
	From 7 years	From 1 to 10	110,33	9,23
		Above 11	109,25	19,40

The ANOVA two way test relating practice time and competitions numbers showed that, to state competition level, practice time factor presented a meaningful effect about the DTK level ( $F=3,688; p \leq 0,049$ ), demonstrating that experts players presented higher DTK level. Yet, the competitions number factor and interactions between two variables did not present effect over the DTK level ( $F=0,241; p \leq 0,625$ ) and ( $F=0,241; p \leq 0,625$ ) respectively.

In national competitions, the practice time, competition number and interaction factors, among them did not identify any effect over the DTK level ( $F=0,537; p \leq 0,466$ ), ( $F=0,287; p \leq 0,593$ ) and ( $F=0,146; p \leq 0,704$ ) respectively].

Considering the situation of the sample where there were tennis players who never competed in the national level, but only in state level, the ANOVA one way showed that these tennis players differ each other statically in DTK scores of tennis players who compete nationally ( $F=3,712; p \leq 0,028$ ). After verified the variances equality ( $p \leq 0,288$ ) the Bonferroni post hoc which pointed the statistical difference was found among the tennis players who compete only in state level ( $93,56 \pm 23,79$ ) and national level tennis players who competed above 11 times ( $107,08 \pm 19,05$ ) with  $p \leq 0,035$ .

The results above indicate that tennis players from the sample who competed in national competitions from 11 tournaments, have higher DTK level than tennis players who competed only in state tournaments. When the Pearson test was performed, was not found any correlation between DTK level and absolute practice time and age variables.

## 4. Discussion

The tennis hits are divided in two large groups: the definition hits (with depth or angled, left, net approach and pace) and preparation hits. The definition hits include all of those used by tennis players with the aim to become its move indefensible to the opponent [55]. These hits support with hits found in this research in point setting situation.

The results of this research show the points majority were defined through hits from the baseline (48,5%) against a sum of 51.5% of volley actions, approach and passing shot. It happens because of the tactical action has been worked well to intimidate the opponent. Coe e Miley [56], claim that 85% of points are disputed in the backcourt. High speed worked

on the ball in the current game limit the players of having many opportunities to reach the network.

To avoid unforced mistakes, the athletes work the point searching for the tactical advantage with empty spaces and bad opponent position in attempting to produce mistakes from de opponent. Tennis players use different strategies when they play in different surfaces. In Grand Slan tournaments between 1997 and 1999 the rallies proportion in the baseline presented the following results:

French Open, 51% points, Australia Open 46% points, USA Open 35% points [57]. The results of technical action frequency are related to these results in baseline movements on slow and fast floors. If the rally exchange occurs in the baseline, then the most part of the technical-tactical actions are bottom hits.

In the role developed according to the judge's evaluation, the video scenes in most part were clear, relevant and related to the evaluation proposal in perception and decision making in tennis. It is interesting notice that 4 items which were discarded by not reaching CVC numbers of  $\geq 0.80$  did not adjust only to the image clarity criteria, following the cut off numbers studies of [8],[46],[49]. These results suggest that scenes selection in the search of a better empirical analysis.

To cover, at least, much of the semantic construct extension it is recommended a test which has a final number of 20 items [6]. To this purpose, psychometry admits that validation process must begin from a theory. Nevertheless, this research presents a high accuracy since the choice and consolidation video scenes, which had started with 192 scenes.

The hypothesis that would be possible validate theoretically a satisfied number of items to the construction of TDTK:TN, could be confirmed after the validation model application in psychometric tests. Researches based on psychometric validate, at the most, questionnaires, personality tests and educational tests. Thus, the usage of theoretical reference suggest by Pasquali [6],[7],[8] was appropriated for this type of test which uses moving images. The papers of [40],[43],[42],[47], were also regarded in the achievement steps of validity and reliability obtained.

The agreement among the observers (CEO), following values criteria to discard under 80%, as well as the ecological validity kept 20 items which followed an extensive way in validation to an instrument construction.

The systematic reduction of 192 scenes which has become into 43 items and finished in 20 selected items present both validity in visual quality, practical relevance and representativeness, as the ecological validity to a future items application with tennis players. Besides, reliability numbers by reproducibility and objectivity were over 80.

The challenge of using data for the template creation in qualitative order until they were represented quantitatively, has brought expansions about the technical analysis of discursive data, indicating alternatives in order to in an unique research, both qualitative and quantitative approach could be related to produce the results of this research.

Researches performed in comparing practice sports time in tennis and the DTK level have been the researches focus, however, time practice should not be analyzed as an isolated factor, knowing that factors like competitive levels to this practice application, the frequency and duration of the workout sessions are also important factors.

In this current research the time influence after 7 years practice in this sport caused effect over the DTK level in tennis only among athletes who compete in state level, but the same effect was not observed in national level. This fact supports the research[39] and claims the reason for this difference is the level improvement for decision making to tennis players with experience above 6 or 7 years. However, in the research indicated above, the competitive level of tennis players was not exposed. It is emphasized that decision making and its study in competitive productivity is one of the cognitive process necessary to verify DTK level with perception[49].

On the other hand, researches[28],[32],[35], assert that only two years of practice experience is enough time to promote meaningful differences in DTK level, which was not found in this current research.

Related to number competition factor and interaction between this factor and practice time there was not any effect over DTK level. However, concerning about the variable participation in competitions, tennis players who competed in state tournaments, but not nationally, obtained slighter DTK levels when compared to competitors who participated in 11 tournaments above. It indicates the different performance in competitive levels of tactical knowledge.

These results run directly to the research[32] which points experts tennis players who participated in an average of 14 competitions, however, the requirement level of the competitions was not exposed. Other researches in tennis consider the participation in competitions develop the ability in decision making in real space and time game situations[1],[12],[10],[32],[39].

Among the papers investigated in tennis was not found correlation evidence between DTK level and practice experience in tennis. The researchers used the relation between the cited variables are the basketball and field football sports. Similar to these found in researches[58-60], in Field Football, the athletes with higher practice not necessarily were those who obtained the best results in DTK. However, the research[61] showed the meaningful positive correlation between DTK level and practice experience in basketball players.

## 5. Conclusions

The observation and video analysis in tennis created an opportunity to determine the technical-tactical actions types most used in point setting. The most of the defining actions points made by tennis players occurred in the baseline. Even situated in the baseline and irrespective of floor type, tennis players tend to be really aggressive.

Considering aspects of different floors, the technical-tactical actions analyzed, contribute to the knowledge of the productivity technical-tactical of athletes in current tennis. To understand the way the expert athletes execute their actions, depending on the game conditions such as, floor type and distinct opponent, it is important to create teaching-learning-training processes to be applied in several productivity levels concerning about the sporting excellence.

The hypothesis that is possible to validate a satisfactory item numbers to the creation of DTK evaluation instrument in tennis could be confirmed by content validation, showing this method, also adjust to validate not only questionnaires, as well as moving images.

The applied time to this research emphasized discussion about validity epistemology created by historical, philosophical and statistical events than validated tests measure in fact of what is supposed to measure. The conclusion of these thoughts which surrounded the steps searching for reliability and validity was expressive to the applied methodological process could reach the proposed goals. It seems clear that a selected theoretical model could be empirically proved through a correlation found between perception and decision making, which supports in the concept definition of tactical knowledge, in this case, declarative.

Regarding the last step of this research which was the verification time influence and tournament numbers in different competitive levels about DTK tennis players by an application of pilot test, was observed only the practice time factor in state competitive level which had influence in DTK level. Besides, DTK level had modified when compared with competition tennis players in state and national competitions from 11 competed tournaments.

While increases the practice time in tennis and experience in national tournaments, increases DTK level, factor not found yet in other investigation in tennis.

To Sports Sciences these results have an important pedagogical worth, because it is verified a DTK level development which requires a long-term training, concerning about technical tactical methodological process, as well as the participation in different required level competitions.

This type of validation contributes as a pedagogical resource, on the greatest knowledge in sports and DTK development level of tennis players since the first years of competition up to the adult/professional level. The test application will become possible to plan teaching-learning-training process in tactical knowledge. Temporal evaluation into the training process period will allow the appropriate formation process regulation.

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