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METHODOLOGICAL JOURNAL<http://mentaljournal-jspu.uz/index.php/mesmj/index>POLYMODAL ORGANOLEPTIC DIAGNOSIS OF SENSORY-PERCEPTUAL
COMPETENCE IN VOCATIONAL EDUCATION — THE SEVEN-STATION
PROTOCOL AND THE SENSORY PASSPORT**T. B. Yusupova***Master of production education**Jizzakh Advanced Vocational Skills Technical College**E-mail address: tursunoy1112@gmail.com**Jizzakh, Uzbekistan*

ABOUT ARTICLE

Key words: sensory-perceptual competence, polymodal diagnosis, organoleptic assessment, vocational education, sensory passport, neuropedagogy, modal components, perceptual learning, diagnostic protocol, professional perception, cognitive load, sensory adaptation.

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Abstract: The article substantiates a polymodal organoleptic procedure for diagnosing the sensory-perceptual competence of learners in vocational education institutions. The weakest link of any methodology that aims to develop professional perception is the objective measurement of that perception, since conventional forms of assessment record the result a learner reaches and leave the perceptual process behind that result unexamined. The article argues that the widespread practice of reducing the diagnostic stage to the visual, auditory and kinaesthetic typology is both empirically unsupported and pedagogically unproductive, and it proposes an alternative in which the competence is operationalised as a matrix of seven modal components crossed with four functional layers. The diagnostic instrument built on that matrix is a circuit of seven stations through which the whole group passes in two practical sessions, with a neutral pause inserted between the gustatory and the olfactory station to counter sensory adaptation. The stimulus materials of each station are adapted from international sensory analysis standards, and the three differences that separate industrial panel testing from pedagogical diagnosis — the purpose, the attainable precision, and the size of the

descriptive vocabulary — are stated explicitly. The results of the circuit are recorded in a sensory passport which is completed together with the learner rather than kept from the learner, and three uses of that record are described. The procedure requires no laboratory equipment and no preparation in the neurosciences on the part of the production-training master.

Introduction. A learner in the food-preparation trades may know the temperature regime of a dish by heart and still take it off the heat too early. The failure is seldom one of memory. It is a failure to notice that the colour has not yet turned, that the sound of the boil has changed, or that the resistance of the product under the knife no longer matches the expected standard. In welding, sewing, agro-technology and health-care training the same pattern is observed, because in all of these fields quality is judged in the first instance through the senses and only afterwards through instruments. The ability at stake may be named sensory-perceptual competence — the capacity to isolate multichannel sensory information arriving from the professional environment, to compare it against professional standards, and on that basis to take a justified decision about quality.

Competence-based vocational education has established the general principle that instruction should be aligned with demonstrable professional performance [20]. The principle, however, is of little help where the performance in question is perceptual, because the perceptual act leaves no visible trace. The conventional forms of control used in vocational institutions — the test, the oral question, the practical assignment — record what the learner produced. They do not record how attention was distributed, what strategy was used to search the object, or how quickly an error was noticed. The diagnostic stage is therefore the weakest link of any methodology that undertakes to develop professional perception, and a developmental methodology whose starting measurement is unreliable is a methodology without an address.

The answer most often given to this difficulty in vocational practice is the visual, auditory and kinaesthetic typology. A learner is assigned to one of three types and is then taught, so the reasoning runs, through the channel of that type. Two objections stand against this practice. The first is empirical. Repeated tests of the matching hypothesis have failed to support it, and the belief that teaching through a preferred modality improves learning is classified in the research literature as a neuromyth rather than as a finding [8]. Surveys of teachers show that the belief is held very widely, including among teachers who are

enthusiastic about neuroscience and who are therefore more, not less, exposed to it [9; 10]. The second objection is pedagogical. The typology is built on three channels, whereas professional perception in the food-preparation trades runs through at least six, and the three it omits — taste, smell and the vestibular-proprioceptive sense — are precisely the ones on which the quality decisions of the trade most often rest.

There exists a body of procedure that does take all of these channels seriously, namely the sensory analysis practised in the food industry and codified in international standards [17; 18; 19] and in the methodological literature of the field [15; 16]. That body of procedure cannot be transferred into a vocational workshop unchanged, because it was built for a different purpose. Industrial sensory analysis selects assessors, and a candidate whose sensitivity falls below a threshold is not admitted to the panel. Pedagogical diagnosis cannot work on a selective logic, because a low result is the reason the learner is in the classroom.

The aim of the present article is to substantiate a diagnostic procedure that takes the full set of professional channels from industrial sensory analysis, converts its selective logic into a developmental one, and fits the result into the time, the equipment and the staffing that an ordinary vocational institution actually has. Three questions guided the work. How should the competence be operationalised so that a diagnostic result names a place for pedagogical action rather than a global level. What stimulus materials and what order of administration make a seven-channel measurement possible inside two practical sessions. And how should the result be recorded so that it serves the formation of the learner's own self-regulation rather than remaining the master's private document.

Materials and methods. The study follows the logic of educational design research, in which an instructional solution and the theoretical claims behind it are developed together through successive cycles of design, enactment and revision. The work proceeded in three phases. The analytic phase established the structure of the target competence and the constraints of the workshop setting through documentary analysis of the vocational programme documents for the cook trade, observation of practical sessions, and interviews with production-training masters. The design phase produced the competence matrix, the seven-station circuit and the sensory passport. The formative evaluation phase submitted these to expert appraisal by production-training masters and methodologists and to trial enactment, and the revisions that followed were fed back into the design.

The setting was a vocational technical college preparing cooks. The trade was chosen because it is one of the few in which all six sensory channels carry professional information at

the same time, and in which the gustatory and olfactory channels, normally absent from instructional design altogether, are decisive for the quality decision.

The theoretical grounds of the procedure are drawn from three directions. The first is the theory of sensory integration, which holds that information arriving through different channels is combined into a single adaptive response rather than processed in parallel isolation [4]. The second is the research on perceptual learning, which shows that discrimination improves with structured exposure and that expertise consists in large part of a reorganisation of what the perceptual system extracts from a scene rather than of an accumulation of facts about it [5; 6]. Studies of perceptual learning modules indicate that short, varied, feedback-rich discrimination trials transfer to authentic tasks, which is the warrant for using brief calibrated sensory episodes rather than extended laboratory sessions [6]. The third is the evidence on multisensory facilitation, according to which material encoded through several modalities is retained more robustly than material encoded through one, provided that the modalities carry congruent content [7]. The proviso matters for diagnosis as much as for teaching, since channels added without being bound to a specific quality marker raise cognitive load instead of raising the quality of the measurement [13].

The stimulus materials of the circuit were formed by adapting the test types described in the international sensory analysis standards to a pedagogical purpose [17; 18; 19]. Three differences between the industrial and the pedagogical application were fixed at the design stage and are set out in Table 1. They govern every subsequent decision about materials, precision and vocabulary.

Table 1. Three differences between industrial and pedagogical sensory diagnosis

Parameter	Industrial sensory analysis	Pedagogical diagnosis
Purpose	Selection. A candidate whose sensitivity is below the threshold is not admitted to the assessor panel	Development. A low result is the address of the developmental work, and no learner is excluded on the strength of it
Precision	Solutions are prepared on an analytical balance; temperature and illumination are controlled	Such precision is neither attainable nor necessary in an institution; for a pedagogical purpose relative differences suffice
Vocabulary	Assessors master several dozen descriptive terms	Six to eight anchor terms per modal channel, so that the vocabulary does not itself become the source of cognitive load

The measurement conventions were fixed as follows. All indicators are expressed on a five-point scale. The overall level is read as low from 1.00 to 2.49, as medium from 2.50 to 3.99,

and as high from 4.00 to 5.00. Blocks of Likert-type items are converted to the five-point scale through the arithmetic mean rather than through the sum, so that blocks of unequal length remain commensurable. Each instrument of the diagnostic package is tied to the four criteria and the seven modal components of the matrix described below, and test items are distributed across the seven components, two to a component with the integrative component carrying the remainder; a parallel form is required for the final measurement.

The statistical apparatus planned for the experimental trial is stated here because it constrains the design of the instrument. Normality is checked by the Shapiro—Wilk test, after which either the Student t test or the Mann—Whitney U test is applied. The distribution of learners across the three levels is compared by the chi-square test with two degrees of freedom, for which the critical value at the five per cent level is 5.99. Effect size is expressed by Cohen's d, and the significance threshold is set at p less than 0.05. The summative results of the experimental trial fall outside the scope of the present article and are reported separately.

Ethical requirements were fixed before the first enactment. Diagnostic results are not used for selection under any circumstance. The sensory passport is completed together with the learner and discussed with the learner, since a document kept from the person it describes cannot serve the formation of self-regulation. Tasting and smelling tasks are governed by the workshop hygiene regime and by the individual dietary and safety restrictions recorded before the session, and participation in any such task is voluntary.

Result and discussion. An instructional aim expressed as the development of sensory-perceptual competence is not actionable, because it names no place at which the master should intervene, and a diagnostic result expressed as a single overall level is not actionable for the same reason. The competence was therefore operationalised along two axes. The first axis lists seven modal components, six of them channels of the professional environment and the seventh the integrative act that fuses them into a decision. The second axis lists four functional layers through which any of those components passes — the motivational-affective layer, which carries professional interest and affective readiness for sensory experience; the cognitive-standard layer, which holds the system of professional sensory standards and the vocabulary in which they are expressed; the operational-perceptual layer, which comprises the perceptual actions of discrimination and integration; and the reflective-regulatory layer, through which the learner monitors perception, detects error and corrects it. Their intersection yields twenty-eight addresses for pedagogical action.

The practical consequence of this arrangement is that a diagnostic result ceases to be a verdict. A learner with a weak olfactory component at the cognitive-standard layer lacks a

vocabulary of aroma descriptors and needs that vocabulary; the same weak component at the operational-perceptual layer indicates a discrimination threshold and needs practice in discrimination. The two findings look identical on a single overall scale and require entirely different action from the master. Table 2 sets out the seven components, the way each of them appears in the activity of the trade, and the indicator by which each is measured.

Table 2. Modal components of sensory-perceptual competence and their diagnostic indicators

№	Component	Manifestation in professional activity	Diagnostic indicator
1	Visual	Colour, structure and sheen of readiness; visual estimation of a portion	Share of correctly ordered samples in a colour series; portion error, per cent
2	Auditory	Sound of frying, intensity of boiling, crispness	Share of correctly identified process sounds
3	Kinaesthetic-tactile	Elasticity of dough, tenderness of meat, temperature, consistency	Number of pairs correctly discriminated with vision occluded
4	Gustatory	Balance of the basic tastes and the decision to correct it	Recognition threshold; number of ranking errors in a graded series
5	Olfactory	Recognition of spices by aroma; markers of freshness and of scorching	Share of aromas recognised; response latency
6	Vestibular-proprioceptive	Working posture, distribution of force on the knife, precision of movement	Mean deviation of slice thickness, mm
7	Integrative-reflective	Fusion of the markers into a single ready or not ready decision	Correspondence of the decision to the standard; completeness of the justification

The instrument built on this matrix is a circuit of seven stations through which the whole group passes. The circuit occupies approximately ninety-three minutes and is therefore distributed over two practical sessions. Its composition is given in Table 3. Each station carries its own stimulus material, its own answer sheet and its own scoring key, and the group is divided so that no station holds more learners than its materials allow.

Table 3. Composition of the seven-station diagnostic circuit

Station	Task and stimulus material	Time
1. Visual	Ordering a colour series of five samples of one product at different degrees of doneness; visual estimation of a portion against a reference card	12 min

Station	Task and stimulus material	Time
2. Auditory	Identification of six recorded technological sounds in fragments of ten to fifteen seconds	10 min
3. Kinaesthetic-tactile	Discrimination of three dough consistencies and three water temperatures with the eyes covered	12 min
4. Gustatory	Recognition of the four basic tastes at low concentration; ranking of a five-step series of salt solutions	15 min
Neutral pause	Removal of sensory adaptation — water, fresh air, no task	5 min
5. Olfactory	Recognition of eight spice and foodstuff aromas in identical opaque containers	12 min
6. Vestibular-proprioceptive	Evenness of the cutting movement on standard vegetable samples, measured with a rule; stability of the working posture	12 min
7. Integrative-reflective	A ready or not ready decision on a prepared sample and its verbal justification by channel	15 min

Three features of this arrangement require comment. The first is the neutral pause between the fourth and the fifth station. Taste and smell are the two channels most subject to adaptation, and a learner who passes directly from a series of salt solutions to a set of aromas carries a depressed sensitivity into the second measurement. The pause is not a rest break inserted for comfort but a methodological element, and removing it invalidates the olfactory result. The second feature is the order of the stations, which moves from the channels that can be measured without contact to those that require it, so that the hygiene regime of the workshop is not broken mid-circuit. The third is the limitation of the descriptive vocabulary to six or eight anchor terms per channel. Industrial assessors master several dozen terms, but in vocational education a vocabulary of that size consumes working memory that the measurement itself requires, and the number of terms was therefore capped by design rather than by convenience [13].

Two rules govern the administration of the circuit and are stated at the front of the diagnostic package rather than in a methodological note, because trial enactment showed that masters accustomed to industrial sensory analysis read a low score as a ground for excluding a learner from demanding tasks. The first rule is that the diagnosis is not a selection. A low result marks the address of the developmental work and nothing else, and no learner is removed from any task on the strength of it. The second rule is that the data are open to the learner. The sensory passport is not the master's concealed working document; it is completed jointly with

the learner and discussed with the learner, because the reflective-regulatory layer of the competence cannot be formed in a person who is not allowed to see the record of their own perception. Feedback exerts its strongest effect when it addresses the process by which a result was reached rather than the result alone [21], and a record that the learner cannot inspect cannot carry process feedback at all.

The results of the circuit are entered in the sensory passport, a single sheet that holds the learner's profile across the seven components and the four layers, the date of each measurement, and the developmental address derived from them. The passport is opened at the entry measurement, updated at the interim and the final measurement, and read before each cycle of practical work. Its value lies in making the dynamics visible to the learner, since a component that has moved from a low to a medium level over a module is evidence of the learner's own progress and functions as a motivational resource that no general grade can supply.

The record is put to three uses. The first is the composition of learner pairs. Learners whose strong and weak channels complement one another are set to work together, so that the one who hears the change in the boil and the one who sees the change in the colour arrive at the decision jointly and each names for the other a marker the other had not attended to. The second is the selection of individual supplementary tasks, drawn from the same stimulus bank as the circuit itself and addressed to the weak channel. The third is the deliberate use of sensory compensation. A weak visual channel is partly offset by strong auditory and tactile channels, and the master who knows which channels are strong can route the quality decision through them while the weak channel is being developed. This use of the profile is the point at which the present approach must be distinguished most carefully from the typology it replaces. The profile is never used to choose the channel through which the topic is taught, since that would reproduce the matching hypothesis the evidence does not support [8]. Teaching remains polymodal for every learner; only the supplementary work is individualised.

The procedure may be compared with the three alternatives available to a vocational institution. Against the visual, auditory and kinaesthetic typology it offers seven components instead of three, an indicator for each of them instead of a self-report questionnaire, and a result that names a layer as well as a channel. Against industrial panel testing it offers a developmental rather than a selective logic, a precision calibrated to what a workshop can actually deliver, and a vocabulary scaled to the working memory of a fifteen to nineteen year old learner. Against the ordinary practical assessment it offers a measurement of the perceptual process rather than of its product. The claim that the learner's capacity for sensory discrimination can be developed

at this age at all rests on the evidence that neural structures are reorganised by experience throughout life, so that the notion of a closed critical period for sensory development provides no ground for inaction [11; 12].

Three limitations bound these claims. The circuit was designed within a single trade and a single institution, and although its underlying rationale is not specific to food preparation, its transfer to a trade in which the gustatory and olfactory channels carry no professional information would require the matrix of components to be re-specified. The precision of the gustatory and olfactory stations is lower than that of an instrumented laboratory, and the procedure accordingly supports statements about relative differences between learners and about change within a learner, not statements about absolute thresholds. And the procedure depends on preparation — the solutions, the recordings, the dough samples and the aroma containers must be ready before the session, and a station improvised on the day produces a number that looks like a measurement without being one. The psychological grounding of the instrument also draws on the general apparatus of psychodiagnostics and experimental psychology as it is set out in the national educational literature [3], and on the general theory of perception within which the modal channels are described [2], while the pedagogical framing of the diagnostic stage follows the treatment of diagnosis in the theory of education [1].

One further consideration belongs to the discussion rather than to the result. The circuit begins with a station in which the learner tastes and smells real products, and the affective tone of that first contact is not neutral. The evidence that an external stimulus is appraised emotionally before it is analysed cognitively [14] implies that a diagnostic session conducted as an examination produces a different measurement from one conducted as an exploration. The protocol therefore prescribes that the circuit is announced as an exploration of what the learner can already perceive, and the stations are arranged so that the first task of each is one that almost every learner completes successfully. The learner's perceptual action is in any case performed first in an external, verbalised form and only afterwards internalised and abbreviated [22], so the requirement at the seventh station that the decision be justified aloud is not an addition to the measurement but part of it.

Conclusion. The diagnosis of sensory-perceptual competence is the point at which methodologies for developing professional perception most often fail, and the conclusions of the present article may be stated in four points.

First, the competence is measurable only if it is first operationalised. A matrix of seven modal components crossed with four functional layers converts a diffuse aim into twenty-eight addresses, and a diagnostic result expressed in those terms names both the channel and the

layer at which the work is to be done. A single overall level, however carefully computed, cannot do this.

Second, the stimulus materials of industrial sensory analysis can be carried into vocational education, but its logic cannot. The purpose changes from selection to development, the attainable precision falls and does not need to be restored, and the descriptive vocabulary is capped at six to eight anchor terms per channel so that the vocabulary does not consume the working memory the measurement requires.

Third, a seven-station circuit with a neutral pause between the gustatory and the olfactory station measures all seven components inside two practical sessions, with no laboratory equipment and with materials drawn from the ordinary stock of the workshop. The pause is a methodological element and not a convenience, since sensory adaptation otherwise depresses the olfactory result.

Fourth, the record of the measurement belongs to the learner as much as to the master. A sensory passport completed jointly and discussed openly makes the learner's own dynamics visible and thereby serves the reflective-regulatory layer of the very competence it measures, whereas a concealed record can serve only the master's planning.

Two directions for further work follow. The first is the accumulation of data from the circuit across several groups and several modules, which would permit the reliability of each station to be estimated and the weakest stations to be redesigned. The second is the re-specification of the matrix for trades whose dominant professional channels differ from those of food preparation, which would show whether the seven-station form is a general instrument of vocational diagnosis or an artefact of one occupational field.

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