THE SYNERGETIC APPROACH AS A CONCEPTUAL AND METHODOLOGICAL FRAMEWORK FOR THE PROFESSIONAL DEVELOPMENT OF ACADEMIC STAFF

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Abstract. Professional development of academic staff, i.e. the continuous reconstruction of professional competence in response to changing conditions of academic work, is a decisive factor of quality in higher education, yet it is still interpreted predominantly through accumulative models that treat it as a graduated ascent secured by externally designed provision. *The purpose of the paper* is to demonstrate the heuristic potential of the synergetic approach as a conceptual and methodological framework for interpreting the professional development of academic staff within the paradigm of self-organising systems. The solution of such research problems determines the logic of the presentation of the studied material in the paper: systematisation of achievements in the theory and practice of professional development of academic staff as an object of pedagogical research; reconstruction of the reception of synergetics in educational thought and identification of the object to which its apparatus has not yet been applied; theoretical substantiation of openness, non-linearity, self-organisation, instability and emergence as an interconnected set of analytical categories of professional growth. *Methodology of the study* is based on general research methods of analysis and synthesis, comparison and generalisation, abstraction and conceptual modelling, which are used to systematise achievements in the theory and practice of professional development in the pedagogy of higher education. *Results of the survey* showed that synergetics has been actively

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used in educational research since the last decade of the 20th century, but almost exclusively in application to the educational process, the learning environment and the student, whereas the teacher has figured as the agent arranging conditions for self-organisation rather than as a self-organising system. Professional development in the synergetic reading is understood as an open process of exchange with the professional environment, non-linear in tempo, multivariant in outcome, driven by the teacher's own goal-setting and reflection, and productive of integrative qualities irrecoverable from an inventory of separate competences. The comparison of the two readings is carried out according to eight parameters, among them the leading factor of change, the position of the teacher, the status of instability and the criterion of effectiveness. *Practical implications.* Standardisation of provision has a limit beyond which uniformity reduces effectiveness; a bifurcation point calls for a response opposite to that appropriate to a deficit; competence inventories under-register what the approach identifies as decisive. *Value/originality.* The wartime experience of Ukrainian academic staff, whose development continued after institutional scaffolding had been removed, is examined as an illustration of self-organisation operating without external management.

INTRODUCTION

Few questions in the study of higher education have proved as resistant to settled answer as the question of how university teachers become better at what they do. The difficulty is not a shortage of provision. Universities across Europe and beyond maintain induction programmes, teaching certificates, mentoring schemes, methodological seminars, research sabbaticals and, increasingly, digital learning platforms addressed to their own staff. The difficulty lies rather in the persistent gap between what such provision is designed to produce and what can subsequently be observed in the professional conduct of those who have received it. Two teachers who complete identical programmes frequently emerge from them transformed to entirely different degrees; a colleague who has attended nothing at all may nevertheless have undergone the more consequential change. This is not a marginal anomaly. It is a regular feature of professional life in universities, and a conceptual framework that treats it as noise rather than as evidence has already conceded something important.

Novelty and relevance. The novelty of the position advanced in this chapter lies in bringing together two bodies of scholarship that have developed largely in isolation from one another. The first is the substantial literature on the continuing professional development of academic staff, which has established what forms such development takes, what academics actually do when left to organise it themselves, and under what conditions it produces durable change in professional behaviour [13; 14; 15; 17; 19; 22]. The second is the reception of synergetics in educational thought, which has supplied pedagogy with a vocabulary for describing systems that are open, non-linear and capable of generating order from within [2; 3; 7; 10]. The first tradition has documented the phenomenon without possessing an adequate language for its irregularity; the second has developed that language while applying it almost exclusively to students, to the learning environment or to the educational process, rather than to the teacher considered as a developing system in his or her own right. The relevance of joining them is heightened by circumstances that have made the irregularity impossible to ignore: the digital reconstruction of university teaching [20], the appearance of artificial-intelligence tools whose pedagogical consequences no existing programme was designed to address, and, in Ukraine, the abrupt removal of institutional scaffolding under conditions of war [6].

The aim of the chapter is to substantiate the synergetic approach as a conceptual and methodological framework for interpreting the professional development of academic staff, to elaborate its constitutive characteristics in relation to this object, and to establish what follows from that elaboration for institutional practice. The aim is pursued through three research tasks. The first is to establish how professional development has been conceptualised in the existing scholarship, what forms it takes in the practice of higher education institutions, and where the explanatory limits of the prevailing conceptualisation lie. The second is to reconstruct the reception of synergetics in educational research, to distinguish the lines along which that reception has proceeded, and to identify the object to which the synergetic apparatus has not yet been systematically applied. The third is to elaborate openness, non-linearity, self-organisation, instability and emergence as an interconnected set of analytical categories for the professional growth of academic staff, and to derive the institutional consequences of adopting them.

Methodology and logic of presentation. The study is theoretical in design. Its purpose is not to measure the outcomes of particular development programmes but to clarify the grounds on which such outcomes may be interpreted at all, and the procedures employed therefore belong to conceptual rather than empirical inquiry. Analysis and synthesis of the source base reconstruct the two traditions and locate the point at which they fail to meet. Parametric comparison sets the accumulative and the synergetic readings against one another across a defined set of parameters. Conceptual modelling transfers the characteristics of self-organising systems to the object under study. Generalisation integrates them and derives their consequences. The presentation follows the same order. Sections two to four examine professional development as it has been conceptualised in the literature, the forms it assumes in institutional practice, and the limits of the accumulative reading. Sections five and six turn to synergetics and to the comparison of the two paradigms. Sections seven to eleven elaborate the five characteristics in turn. Sections twelve to fourteen consider their interaction, their institutional implications, and the limitations of the argument. The conclusions summarise the position and set out directions for its empirical verification.

1. Professional Development as a Concept

Before the synergetic apparatus can be applied to the professional development of academic staff, the object to which it is to be applied requires definition, and the scholarship offers more than one. The term itself has expanded considerably over the past three decades. Guskey and Huberman [16] frame the field in terms of a movement between paradigms, signalling that the practices then current had come to be regarded as insufficient and that the conceptual foundations of professional development, rather than merely its delivery mechanisms, were under revision. The signal proved accurate. What had been understood as a species of training (the transmission of specified content to practitioners assumed to lack it) was progressively reconceived as a process of professional change extending across a career and embedded in the daily work of teaching rather than separated from it.

The consequences of that reconception are most clearly worked out by Guskey [15], whose account of the relationship between professional development and teacher change reverses an assumption that had governed

programme design for decades. The intuitive model runs from belief to practice: convince a teacher of the value of a new approach, and altered classroom behaviour will follow. Guskey argues that the sequence more commonly runs the other way. Teachers alter their practice first, often provisionally and without conviction; belief follows only when the altered practice is seen to produce better outcomes for students. The implication for the design of provision is considerable, since it locates the decisive moment not in the seminar room but in the period afterwards, when the teacher attempts the new practice and observes what it yields, a period over which the provider of the programme has little control and which, in most evaluation designs, is not observed at all.

Antoniou and Kyriakides [13] pursue the question of durability directly. Their dynamic integrated approach to teacher professional development is constructed around the problem of impact and its sustainability: not whether an intervention produces measurable change in teacher behaviour and student outcomes, but whether that change persists once the intervention has ended. The framing is significant for the present argument in two respects. It treats professional development as a dynamic process rather than a discrete event, and it acknowledges that the effects of an intervention are mediated by factors internal to the teacher and to the working environment, so that identical interventions may yield divergent trajectories. The vocabulary is not synergetic, but the phenomenon being described, an intervention whose consequences depend on the state of the system receiving it, is one that synergetics was formulated to handle.

Within Ukrainian scholarship, the theoretical and methodological dimensions of the problem have been examined by Mukan and Hrohodza [5], whose analysis of the professional development of educators addresses the conceptual foundations of the field rather than the design of particular programmes. Earlier work by Mukan [4], drawing on the experience of the United Kingdom, Canada and the United States, identified school leadership as a condition of effective teacher development, thereby locating a determinant of professional growth outside the individual teacher and outside the content of any programme. The observation matters here because it establishes, on comparative evidence, that professional development is conditioned by the environment in which it occurs, the proposition that the openness characteristic will later formalise. Titova [9] extends the analysis

to the specific circumstances of teaching staff in professional colleges, examining how contemporary challenges reshape the requirements placed upon them and, by implication, how far provision designed under earlier conditions can continue to serve.

Three features of this literature deserve emphasis, since the argument of the chapter depends on them. The first is that professional development is now understood as extending across a career rather than being concentrated in its early stages: the qualified teacher is not a finished product requiring occasional maintenance but a practitioner whose competence must be continuously reconstructed as the conditions of practice change. The second is that its outcomes are recognised to be conditional, on the working environment, on leadership, on the teacher's own disposition, on what happens after the formal provision has ended. The third, and most consequential, is that this recognition of conditionality has not been accompanied by a corresponding revision of the evaluative apparatus. Professional development continues, in most institutional settings, to be planned and audited as though its outcomes were proportional to its inputs. The literature has established the conditionality; it has not yet supplied a framework in which conditionality is the expected case rather than an obstacle to measurement.

2. Forms of Continuing Professional Development

If the conceptual boundaries of professional development have widened, its institutional forms have multiplied correspondingly. Bulvinska and Bulvinsky [14] approach the question empirically, establishing through survey evidence what types and forms of continuing professional development academic staff actually engage in. The value of such an inventory lies less in its individual entries than in the range it reveals. Alongside the formally organised provision that institutions plan and record (courses, certificates, internships, methodological seminars) there exists a considerable body of activity that is neither planned nor recorded: reading in the discipline and beyond it, informal exchange with colleagues, participation in scholarly networks, the preparation of publications, the design of new courses, engagement with international projects. Both categories contribute to professional growth. Only the first is visible to the institution.

King [17] poses the question in its sharpest form by asking what academics actually do by way of continuing professional development, rather than what they are offered. The distinction between provision and practice is the crux. An institution that surveys its own programmes will produce an account of professional development that is accurate as far as it goes and systematically incomplete, because it captures only the portion of the phenomenon that passes through institutional channels. Academic staff, whose professional identity is typically anchored in a discipline as much as in an employing institution, conduct a substantial part of their development through disciplinary rather than institutional channels at conferences, in editorial and review work, in collaborative research, in correspondence with colleagues elsewhere. None of this appears in an institutional audit, and all of it may be more formative than what does.

Nicolau [19] examines the methods of professional development available within higher education institutions, and Wood and colleagues [22] address development for teaching in higher education specifically, a qualification that matters, since the academic role combines teaching with research, and the two dimensions have historically been organised on different principles. Research development has been treated as an intrinsic, largely self-directed activity sustained by disciplinary communities and evaluated by peers; teaching development, far more often, as something delivered to academics by an institutional unit. The asymmetry is instructive: higher education has long known how to support self-directed professional growth, and has applied that knowledge to only one half of the academic role.

The digital dimension has altered the balance again. Usman [20] examines the transformation of lecturer professional development through the integration of digital technology under the conditions of the Society 5.0 era, and the transformation described is not merely a change of delivery medium. When development resources become accessible on demand, the temporal and institutional structure of professional learning changes with them: the teacher chooses what to engage with, when, at what depth, and in what sequence, and the institution's role shifts from provider to enabler. This shift multiplies the available trajectories rather than accelerating movement along a single one, and it therefore intensifies precisely the variability that accumulative models find difficult to accommodate. It also, as the same study indicates, places new demands on the teacher: the capacity to select,

to sequence and to integrate becomes itself a professional competence, and one that no programme confers.

Odarchenko [6] describes what happens when the institutional layer is not merely reduced but disrupted. Under the conditions of full-scale war, many Ukrainian specialists were compelled to relocate or to remain for extended periods in dangerous locations, and the organisational structures that ordinarily sustain formal professional development were severely impaired. What the account records is not the cessation of professional development but its continuation in altered form, self-education pursued independently, scholarly and pedagogical exchange maintained with colleagues in foreign institutions, new professional skills acquired in the absence of any programme designed to confer them. The case is extreme, but its evidential value is precisely a function of its extremity: it demonstrates that the portion of professional development which institutions do not organise is not a supplement to the portion they do, and is capable of sustaining professional growth on its own.

Taken together, this literature establishes a distribution rather than a hierarchy. Institutional provision and self-directed activity are not two grades of the same thing, the second compensating for deficiencies in the first. They are differently structured processes with different logics, and the relation between them is not additive. Formal provision may catalyse self-directed development, may be irrelevant to it, or may compete with it for the finite resource of professional attention. Which of these obtains in a given case depends on the state of the teacher who receives the provision on what that teacher is currently attempting, on what has recently proved unsatisfactory in his or her practice, on which questions are live. This dependence of outcome on initial state is the point at which the descriptive literature reaches the boundary of its own vocabulary.

3. Limits of the Accumulative Model

The model that continues to organise most institutional practice may be stated in four propositions. Professional development consists in the acquisition of knowledge, abilities and experience. Acquisition proceeds by increments, each building on those preceding it. The principal agent of acquisition is external: a programme, a supervisor, an institution that identifies deficits and supplies what is missing. Effectiveness is established

by measuring what has been delivered and received. Each proposition is defensible in isolation, and together they constitute a coherent and administratively convenient account. The difficulty is that each holds only under conditions that the contemporary university increasingly fails to satisfy.

The first proposition assumes that what a teacher needs can be specified in advance. This holds while the content of professional competence is stable enough for its deficits to be identified before provision is designed. It fails when the requirements themselves are in motion. A university teacher confronting generative artificial intelligence in student assessment faces a problem that has no established solution, no consensus among colleagues, and no curriculum from which the answer might be transmitted. Development in such a situation cannot consist in receiving a specified content, because the content does not yet exist; it consists in constructing a workable practice under uncertainty and revising it in the light of what happens. This is a different process, and it is not a degraded version of the first.

The second proposition, that development is incremental, conflicts with what practitioners routinely report. Professional biographies are not smooth. They contain long stretches during which little of consequence changes, interrupted by relatively brief episodes in which a great deal changes at once: a course that fails badly enough to force reconsideration of an entire approach; a period abroad that renders familiar practice suddenly strange; the arrival of a colleague whose work makes one's own look thin. The accumulative model can describe the plateaux. It has no vocabulary for the interruptions, and consequently treats them as irregularities in an otherwise regular process rather than as the moments at which the process does most of its work.

The third proposition locates the agency of development outside the developing subject. Yet the evidence assembled by King [17] and by Bulvinska and Bulvinsky [14] indicates that a substantial portion of what academic staff do by way of professional development is initiated and directed by themselves, and Odarchenko's account [6] shows that this portion can sustain development when the external layer is removed altogether. If external provision were the principal agent, the disruption of institutional structures under wartime conditions would have arrested

professional development; it did not. The proposition survives only if the self-directed portion is treated as marginal, and the evidence does not permit that treatment.

The fourth proposition follows from the first three and fails with them. If outcomes are conditional on the state of the receiving system, then aggregate measures of delivery cannot establish effectiveness, because they presuppose the proportionality that conditionality denies. An institution reporting that ninety per cent of its staff completed the required hours has established that ninety per cent of its staff completed the required hours. Whether professional development occurred is a separate question, and Guskey's analysis [15] indicates where the answer would have to be sought: not in completion records but in what teachers subsequently did in their classrooms and what followed from it. Antoniou and Kyriakides [13] locate it further still, in whether the change persisted after the intervention ended.

None of this establishes that the accumulative model is false. It establishes that the model has a jurisdiction, and that the jurisdiction is narrower than its use. Where competence requirements are stable, where the necessary content can be specified, where compliance must be documented for regulatory purposes, the model performs its function adequately and no alternative is required. The chapter's argument is not that this segment should be abolished but that it should be recognised as a segment. What is required for the remainder, the unplanned, individually variable, discontinuous portion in which the most consequential professional changes appear to occur, is a framework in which those properties are the expected case. That framework is available, and it has been in use in educational scholarship for some time, applied to almost every object except this one.

4. Synergetics and its Pedagogical Reception

Synergetics arose as a response to the explanatory failure of a particular scientific style. Classical science had constructed its account of change around determinism, linearity and predictability: given sufficient knowledge of a system's initial state and of the laws governing it, its future states could in principle be calculated. This account works well for systems that are closed, near equilibrium and composed of weakly interacting parts. It works badly for systems that exchange matter, energy or information with their surroundings, that operate far from equilibrium, and whose components

interact strongly enough that the behaviour of the whole cannot be recovered from the behaviour of the parts. For such systems the interesting questions concern how order arises without being imposed, why small perturbations sometimes produce large effects and sometimes none, and how genuinely new properties come into being.

The transfer of this apparatus to educational scholarship was neither immediate nor uncontroversial, and it has proceeded along three distinguishable lines. The first is philosophical and paradigmatic. Panfilov and Romanova [7] examine education through synergetic categories, treating the transfer as a question about the kind of object education is rather than as a matter of borrowed terminology. Lisova [3] argues that the rethinking of scientific rationality now under way in the methodology of cognition and in the fundamental sciences cannot leave education and its theoretical basis untouched, since synergetics discloses general mechanisms of self-organisation and thereby permits the construction of a holistic processual account of the world in which education figures as an organic component of a single developmental process. Tkachenko [10] presents synergetics in pedagogy as a paradigm rather than a method, and specifies the characteristics by which the paradigm is constituted (openness, non-linearity, self-organisation, instability and emergence) which supply the analytical framework employed in the central sections of this chapter.

The second line is disciplinary. Vozniuk [2] substantiates pedagogical synergetics as a distinct scholarly direction, arguing that synergetics as a transdisciplinary theory of the self-organisation of complex systems represents universal laws of development whose comprehension has long been overdue in the humanities, and that this finds expression in pedagogical thought through the emergence of a new direction whose formation follows from the actualisation of the educational sphere in the context of scientific and technological progress. The claim is stronger than that synergetic terminology may usefully be applied to educational questions; it is that educational phenomena instantiate regularities that synergetics describes, and that pedagogy therefore requires an internal branch equipped to work with them.

The third line is applied, and it is here that both the productivity and the characteristic limitation of the reception become visible. Taranenko

[8] addresses the organisation of the educational process in synergetic terms. Filonchuk [11] applies the approach to the implementation of education for sustainable development, a domain in which the interaction of educational, social and environmental factors resists linear treatment. Vahis [1] interprets the formation of students' professional competence as a synergetic process grounded in self-education and in interdisciplinary connections, and identifies the construction of an educational environment on synergetic principles as a condition of that formation. In each case the object of application is the educational process, the environment, or the student.

International scholarship displays a comparable pattern. Abd Hamid and colleagues [12] propose synergetic pedagogical approaches for higher education in the form of an innovative teaching plan addressed to educators; the plan is designed for teachers, but the system whose synergetic properties are analysed is the learning process it organises. Miao and colleagues [18] apply synergetics theory to the innovation of educational work with university students, operating at the level of institutional arrangement. Vathi and colleagues [21] connect synergetic education with the promotion of creativity and innovation, extending the approach towards questions of social and solidarity economy. The range is considerable and the applications are substantive. In none of them, however, is the teacher himself or herself the system under analysis.

The pattern is not accidental, and identifying its source clarifies what the present chapter attempts. Synergetics entered pedagogy as a theory of how learning systems organise themselves, and the teacher's place within such a theory is naturally that of the agent who arranges the conditions under which self-organisation can occur. This is a coherent allocation of roles and it has produced valuable work. It has also had the effect of exempting the teacher from the analysis. Yet a university teacher is an open system exchanging information with a professional environment, is subject to development that is manifestly non-linear, organises that development largely from within, passes through periods of instability at which trajectories diverge, and acquires qualities not reducible to the components from which they arise. Every condition for the application of the apparatus is satisfied. What is missing is the application.

5. Two Paradigms of Professional Growth

The difference between the accumulative and the synergetic readings is not a difference of emphasis within a shared account. The two proceed from incompatible assumptions about what kind of process professional development is, and they consequently generate different expectations, different research questions and different criteria of success. Setting them out parametrically makes the incompatibility explicit and prevents the synergetic vocabulary from being absorbed as decoration on an unchanged practice, an absorption to which methodological innovations in education are notoriously prone.

The comparison presented in Table 1 employs the parameters identified in the methodology: the character of the process, the leading factor of change, the position of the teacher, the relation to the environment, the predictability of outcomes, the status of instability, the nature of the result and the criterion of effectiveness. Each row states what the two readings assert about the same aspect of the same phenomenon, and the rows are not independent of one another: an institution that accepts the accumulative answer in the first row will find the remaining accumulative answers difficult to avoid, since they follow from it.

Two features of the table require comment. The first concerns the row on predictability. The accumulative reading expects that comparable provision will yield comparable results, and treats departures from that expectation as implementation failures, insufficient attendance, poor delivery, inadequate follow-up. The synergetic reading expects divergence, and treats it as a property of the process rather than as evidence of defect. This is not a difference about how much variation is tolerable. It is a difference about what variation means, and it determines whether an institution encountering divergent outcomes will investigate its delivery or its assumptions.

The second concerns the row on instability. Under the accumulative reading, a period during which a teacher's measured performance declines is a deviation calling for correction: additional oversight, remedial provision, reduced discretion. Under the synergetic reading, such a period may equally be a bifurcation point at which an established mode of practice is being dismantled and a new one has not yet been constructed. The two situations can look identical from outside and require responses that are opposite in kind. An institution that cannot distinguish between them will

apply corrective measures to teachers who are in the middle of the most significant development of their careers, and those measures will tend to arrest precisely the exploratory behaviour on which the transition depends.

Table 1

Accumulative and synergetic readings of academic staff development

Parameter	Accumulative reading	Synergetic reading
Character of the process	Incremental, gradual, uniform accumulation of knowledge, abilities and experience	Non-linear; consolidation alternates with rapid reorganisation
Leading factor of change	Purposeful external pedagogical and organisational influence	Self-organisation of the teacher in exchange with the environment
Position of the teacher	Object of formation; recipient of externally designed provision	Subject of growth; designer of an individual trajectory
Relation to the environment	Unidirectional: the environment sets requirements, the teacher adapts	Bidirectional: the teacher both draws from and reconstitutes the environment
Predictability of outcomes	High; comparable provision is expected to yield comparable results	Low; identical conditions may yield materially different trajectories
Status of instability	Deviation requiring correction; evidence of insufficient preparation	Bifurcation point; condition of transition to a higher level
Nature of the result	Additive: the sum of acquired knowledge, abilities and competences	Emergent: integrative qualities irreducible to their components
Criterion of effectiveness	Completion of prescribed forms and volumes of provision	Capacity to act effectively in novel professional situations

The comparison should not be read as a repudiation of the left-hand column. Its parameters retain explanatory value for the formal, institutionally regulated segment of professional development (the accreditation of programmes, the certification of hours, the documented confirmation of qualifications) and within that segment the accumulative model is not merely adequate but appropriate, since the purpose there is compliance rather than transformation. What the comparison establishes is that this segment does not exhaust the phenomenon. The portion of professional development that is neither planned nor documented, yet frequently proves decisive, becomes

visible only when the parameters of the right-hand column are adopted. The remaining sections elaborate those parameters one by one.

6. Openness of the Developing Teacher

Openness is the condition on which the remaining characteristics depend, since a system that does not exchange with its surroundings has nothing from which to construct new order. In synergetic terms, self-organisation is possible only in systems sustained far from equilibrium by a flow of matter, energy or information across their boundary. Applied to the professional development of academic staff, this means that development is a function of the intensity and quality of the teacher's exchange with the professional, scholarly and educational environment, not a function of internal resources deployed in isolation, and not a function of what any single institution provides.

The range of what crosses that boundary is wide. State educational policy sets requirements and creates or forecloses possibilities. The advance of the discipline renders parts of a teacher's knowledge obsolete and opens questions that did not previously exist. The digital transformation of education, examined by Usman [20], introduces tools that change what teaching can be as well as how it is delivered. International academic cooperation exposes established practice to alternatives that make its contingency visible. Professional communities supply standards, comparisons and interlocutors. Societal expectations shift what universities are asked to produce. Innovative pedagogical practice elsewhere provides models. Each of these constitutes a channel, and the developmental potential of a teacher's situation is largely a function of how many channels are open and how much passes through them.

The exchange is not unidirectional, and this is where the characteristic acquires its specific content for academic staff. A university teacher does not merely adapt to a professional environment that arrives from outside; he or she constitutes part of that environment for others. Through research, the teacher alters the disciplinary knowledge that colleagues will subsequently teach. Through the design of courses and the creation of digital resources, the teacher establishes practices that others adopt. Through supervision, the teacher shapes the next generation of the profession. Through publication and conference participation, the teacher's own experience enters the stock

on which others draw. The academic occupies simultaneously the position of an element within the educational system and that of an agent who reconstructs it, a duality that has no counterpart in the case of the student, and which is the principal reason why the transfer of synergetic analysis from students to teachers is not a mere change of population.

This duality has a consequence that deserves separate statement. Because the teacher's outputs re-enter the environment from which the teacher's inputs are drawn, professional development in a university is a coupled rather than an individual process. A department in which several members are actively developing constitutes a different environment from one in which none is, and the difference is not the sum of the individual differences: each developing member raises the quality of what the others receive. The reverse also holds. Mukan [4], examining school leadership as a condition of effective teacher development on the comparative evidence of the United Kingdom, Canada and the United States, identifies a determinant of professional growth located neither in the individual nor in the content of provision but in the arrangement of the collective, which is precisely what a coupled process would predict.

The institutional consequences are direct. If development depends on the intensity of exchange, then measures that restrict exchange reduce developmental potential regardless of how well the remaining provision is designed. Closing a department to external expertise, limiting participation in professional communities, confining continuing education to internally delivered courses, restricting the time available for conference attendance or collaborative work, each of these narrows the boundary flow, and no amount of internal programming compensates, because the deficit is not in what is delivered but in what is available to be exchanged. Conversely, the deliberate widening of the boundary is itself a developmental measure, even when it takes forms that no audit would classify as training: funded research visits, hosting of external colleagues, support for editorial and reviewing work, protected time for reading outside the immediate specialism.

7. Non-linearity and Trajectory Uniqueness

Non-linearity, in the strict sense, means that the magnitude of a system's response is not proportional to the magnitude of the input that produces it. Small perturbations may be absorbed without visible effect, or may

trigger reorganisation of the whole; large interventions may leave the system essentially unchanged. Applied to professional development, this proposition contradicts the assumption that underwrites most planning in the field, namely that more provision, better delivered, yields more development.

The professional biographies of university teachers exhibit the pattern with some regularity. Long periods of consolidation, during which practice is refined without being reconsidered, alternate with comparatively brief episodes in which a great deal changes: an approach abandoned, a research direction altered, a conception of the teacher's role revised. The tempo of growth, its intensity and its results are determined not by discrete educational measures but by the interaction of the teacher's personal resources, professional motivation, accumulated experience, reflective capacity, the characteristics of the working environment and the nature of the challenges encountered. The same measure applied to two teachers meets two different configurations of these factors and produces two different results.

From this follows the uniqueness of the individual trajectory. Two colleagues who complete the same programme, in the same department, in the same year, may emerge with materially different professional outcomes, and the divergence is not a defect of implementation but a property of the process. Guskey's account [15] indicates one mechanism by which such divergence arises: if belief change follows practice change and is contingent on the teacher observing improved student outcomes, then whether a programme produces durable change depends on whether the teacher's subsequent attempt succeeded, which depends in turn on the class, the discipline, the timing and a range of factors over which the programme has no influence. Antoniou and Kyriakides [13], addressing sustainability, locate a second mechanism in the conditions that determine whether an initial change persists once external support is withdrawn.

The methodological consequence for evaluation is precise. If outcomes stand in non-linear relation to inputs, the effectiveness of provision cannot be established by aggregate measures of participation or satisfaction, since such measures presuppose the very proportionality that non-linearity denies. This does not render evaluation impossible; it relocates it. What becomes relevant is not the quantity of provision delivered but the conditions under which qualitative shifts become possible: whether teachers have reflective time that is genuinely uncommitted, whether they encounter interlocutors

capable of challenging established practice rather than confirming it, whether unfamiliar professional contexts are accessible to them, whether the consequences of a failed experiment are survivable. These conditions are describable and, in principle, measurable. They are simply not what current instruments measure.

8. Self-organisation as Leading Mechanism

If openness supplies the material and non-linearity describes the form of change, self-organisation names the mechanism by which change is produced. The proposition is that the determining factor in professional growth is not external pedagogical influence but the teacher's own activity in designing, organising and correcting his or her professional work and self-improvement. Order is generated from within the system rather than imposed upon it, and the environment functions as a source of material and constraint rather than as a designer.

Self-organisation manifests in a set of capacities that can be enumerated and, in principle, developed. The teacher determines professional goals independently rather than receiving them; anticipates directions in which further development will be required before requirements are formally imposed; selects among available forms of professional learning according to a judgement about what the current situation demands; integrates new knowledge into an existing structure of experience rather than accumulating it alongside; conducts professional reflection on the results of practice; and evaluates his or her own activity against internally held standards. These capacities are neither uniformly distributed nor fixed. They constitute, in effect, a meta-competence, the competence of directing one's own development, which determines how much developmental value a teacher can extract from any given environment.

The evidence that this mechanism operates in the professional lives of academic staff is substantial. King [17], asking what academics actually do rather than what they are offered, describes activity that is largely self-initiated. Bulvinska and Bulvinsky [14] document a range of forms extending well beyond institutional provision. The historical asymmetry between research and teaching development, noted earlier in connection with Nicolau [19] and Wood and colleagues [22], points in the same direction: academics have always organised their research development

largely for themselves, sustained by disciplinary rather than institutional structures, and the results have not been thought inadequate. The question is why the same capacity has been assumed absent in the case of teaching.

The account by Odarchenko [6] of professional development under wartime conditions supplies the strongest available illustration. Displacement, prolonged presence in dangerous locations and the disruption of institutional structures removed much of the external scaffolding on which formal professional development depends. What is recorded is not the cessation of development but its continuation in altered form: self-education pursued independently, scholarly and pedagogical exchange maintained with colleagues in foreign institutions, new professional skills acquired without any programme designed to confer them. Read through the synergetic lens, this describes self-organisation operating in the absence of the external management that accumulative models treat as the principal driver. The evidence is unsystematised and was not gathered to test synergetic propositions, but it is difficult to accommodate within a framework in which external provision is the engine of development.

Recognising self-organisation as the leading mechanism repositions institutional provision rather than dispensing with it. Measures become resources placed at the disposal of a self-organising subject rather than instruments of formation applied to a passive object. The distinction is consequential because resources and instruments call for different institutional logics. Resources require accessibility, variety, and the absence of unnecessary constraint on when and how they are used; their value is realised by the user's selection, and standardisation reduces it. Instruments require uniformity, sequence and control; their value depends on being applied as designed. An institution that has adopted the language of self-directed development while retaining the architecture of instrumental delivery will produce provision that satisfies neither logic (mandatory, uniform, scheduled), nor is justified by an appeal to teacher autonomy that its own design contradicts.

9. Instability, Bifurcation and Choice

Self-organising systems do not develop through uninterrupted equilibrium. They pass through states in which the existing organisation has ceased to be viable, and a new one has not yet been established, states of instability, at which the system becomes acutely sensitive to conditions that

would ordinarily have no effect, and at which the subsequent trajectory is determined. In the professional life of a university teacher such states arise when established modes of pedagogical activity cease to correspond to the requirements of the environment while new models of professional conduct are still in formation.

The occasions are identifiable. The digital transformation of the educational process has placed teachers in this position repeatedly over the past decade, most abruptly during the enforced transition to remote instruction. The assimilation of artificial-intelligence technologies is placing them there now, in a form that is arguably more severe, since it destabilises not only the delivery of teaching but the assessment practices on which academic judgement rests, and does so without any settled professional consensus to draw upon. Participation in international projects exposes practice to standards and expectations against which it may prove wanting. A change of research interests, a transition to interdisciplinary inquiry, or the assumption of a new pedagogical role (the first doctoral supervision, the first programme leadership) each dismantles a working equilibrium and requires that another be constructed. Odarchenko's account [6] describes an extreme instance, in which the destabilisation was imposed by circumstances of a wholly different order.

What distinguishes such periods from ordinary difficulty is the multiplicity of available outcomes. At a bifurcation point the system does not have a determined future; several trajectories are accessible, and which is realised depends on conditions that would be negligible in a stable state. A teacher destabilised by the appearance of generative artificial intelligence in student work may reconstruct assessment practice around it, may retreat to invigilated formats, may reduce engagement with teaching in favour of research, or may leave the profession. All four are available. Which occurs depends on what is encountered at the moment of instability: a colleague who has already reconstructed something workable, an institutional response that treats the difficulty as a failure, an accessible body of practice from elsewhere, the presence or absence of time in which to experiment.

The institutional consequence is a requirement for differentiation that most performance-management systems do not provide. Declining measured performance may indicate a deficit, in which case correction is appropriate: supervision, remedial provision, closer specification of

expectations. It may equally indicate a bifurcation, in which case correction is counterproductive, since it forecloses the exploratory behaviour through which a new trajectory is found and drives the teacher toward the conservative option of retreating to previously adequate practice. The two situations can present identically. Distinguishing them requires attention to what the teacher is attempting rather than to what the teacher has achieved, and it requires that the distinction be made before the response is chosen rather than after it has failed.

Where a period of instability is correctly identified, the appropriate response differs in kind rather than in degree from correction. It consists in the provision of time, genuinely uncommitted time, in which experiments can be conducted and can fail; of professional dialogue with colleagues facing comparable reconstructions; and of a tolerance for temporary decline in measured performance while a new mode of activity is being established. Each of these is administratively awkward, since each amounts to a reduction in accountability at the precise moment when accountability systems are designed to intensify. The synergetic reading supplies the justification for accepting that awkwardness: it identifies these periods as the ones in which the most significant professional development occurs, and it explains why the intuitive institutional response is likely to prevent it.

10. Emergence of Integrative Professional Qualities

Emergence is the appearance, in a system, of properties that belong to the whole and cannot be recovered from an inventory of its parts. Applied to professional competence, the proposition is that the competence of a university teacher is not a mechanical aggregate of knowledge, abilities, skills and discrete competences. In the course of their interaction, integration and practical application there arise new personal and professional formations (pedagogical mastery, professional mobility, innovativeness, readiness for change, digital culture, the capacity for interdisciplinary interaction) which are constituted by the relations among the components rather than by the components themselves.

The distinction can be stated concretely. Pedagogical mastery is not the sum of subject knowledge, methodological technique, communicative skill and assessment literacy. A teacher may hold each of these at a high level and remain unable to read a room, to judge when an explanation has failed before the examination reveals it, or to abandon a prepared sequence when

the class requires something else. Conversely, mastery is recognisable in colleagues whose command of any single component is unremarkable. What distinguishes mastery is the integration of the components into a functioning judgement, and integration is a relation, not an item. The same analysis applies to digital culture, which is not the sum of tool proficiencies but a settled orientation toward what technology can and cannot do for a given pedagogical purpose; and to professional mobility, which is not a list of transferable skills but a demonstrated capacity to reconstitute competence in an unfamiliar setting.

These integrative qualities are what enable a teacher to act effectively under conditions of continuous transformation, and they are therefore what higher education most needs its staff to possess. They are also what current assessment practice is least able to register. An instrument built as an inventory of separate competences will report a teacher who scores adequately on each component while lacking the integrative quality the components were intended to indicate, and will equally fail the teacher who possesses the quality while scoring unevenly on its parts. The failure is not a matter of instrument refinement. It follows from the logic of decomposition: a property constituted by relations among components is not detectable by measuring the components.

What emergence suggests instead is assessment addressed to conduct in complex, unfamiliar professional situations, situations in which integration is required for the situation to be handled at all, and in which its absence therefore becomes visible. Such assessment is more demanding to design and to conduct than competence inventories, is less amenable to aggregation across an institution, and produces results that are harder to defend to an external auditor. These are real costs. The alternative, however, is an apparatus that measures accurately and measures the wrong thing, and that thereby directs institutional attention and teacher effort toward the components at the expense of their integration.

11. Interaction of the Five Characteristics

The five characteristics are not an inventory of independent properties from which an institution might select. They stand in relations of mutual conditioning, and a position that adopted any one of them in isolation would reproduce the partiality that the synergetic approach was formulated to overcome. Openness supplies the exchange without which self-organisation

has no material on which to work. Self-organisation is the mechanism that converts that material into professional change. Non-linearity is the form in which the results of self-organisation become manifest over time. Instability marks the junctures at which self-organisation is most consequential, because it is there that the trajectory is genuinely open. Emergence names the outcome of the whole: the integrative qualities that the process produces and that no component of it produces alone.

The interdependence has a practical corollary that Table 2 sets out. Each characteristic implies a specific institutional condition, and each of those conditions can be defeated independently of the others. An institution may widen the boundary flow while retaining an assessment apparatus that registers only decomposed competences; the exchange will occur and its most valuable products will remain invisible. It may individualise provision while treating every period of declining performance as a deficit; the trajectories will diverge and those on the most productive of them will be corrected back toward the mean. The conditions must hold together, because the characteristics do.

Table 2

Characteristics and the institutional conditions they imply

Characteristic	Institutional condition implied	Typical defeating practice
Openness	Wide, sustained boundary flow: external expertise, mobility, disciplinary networks, protected reading time	Confinement of development to internally delivered provision
Non-linearity	Elective provision matched to what the teacher is currently attempting; evaluation of enabling conditions rather than volume	Uniform prescribed programmes audited by completion rates
Self-organisation	Provision offered as accessible resource; support for goal-setting and selection	Mandatory scheduled delivery justified by an appeal to autonomy
Instability	Differentiated response to declining performance; protected time; a safe channel for reporting failed experiments	Uniform corrective response triggered by performance data alone
Emergence	Assessment of conduct in complex, unfamiliar situations; peer observation of judgement	Competence inventories aggregated across the institution

It follows that the adoption of the synergetic position is not a matter of introducing a new programme, since no programme could instantiate it. It is a matter of altering the assumptions on which existing arrangements rest: what an institution expects development to look like, what it treats as evidence that development has occurred, and how it responds when a teacher's practice becomes temporarily worse. These are assumptions embedded in performance review, in workload allocation, in the criteria for promotion and in the design of quality assurance. The framework advanced here identifies which of them require revision and why; it does not, and cannot, specify the revised arrangements, which depend on circumstances no general framework can anticipate.м

12. Implications for Institutional Practice

Three consequences follow directly from the analysis, and each cuts against an established institutional reflex. The first concerns standardisation. If trajectories are genuinely individual, then the standardisation of development provision has a determinate limit beyond which additional uniformity reduces rather than increases effectiveness. This is a stronger claim than the familiar recommendation that provision be varied. It asserts that beyond a certain point uniformity is actively counterproductive, because it forces teachers at different points of different trajectories through a common sequence, and the developmental value of a resource depends on its match to what the recipient is currently attempting. The practical form of the recommendation is a shift in the ratio between prescribed and elective provision, together with genuine rather than nominal choice within the elective portion.

The second concerns the interpretation of difficulty. Institutional responses to declining performance require differentiation, since the appropriate response to a bifurcation point is opposite in kind to the appropriate response to a deficit. Implementing this is harder than stating it, because the distinction cannot be drawn from performance data alone. It requires a judgement about what the teacher is attempting, which requires a conversation of a kind that performance review in its current form does not typically produce: one in which the admission of a failing experiment is not self-incriminating. Institutions that wish to support development at bifurcation points must therefore create a channel in which such admissions

are safe, and must keep that channel separate from the apparatus that determines advancement.

The third concerns instruments constructed as competence inventories will under-register precisely the qualities the approach identifies as decisive, and no refinement of the inventory corrects this, since the deficiency is in the logic of decomposition rather than in the choice of items. What is required is assessment addressed to conduct in complex, unfamiliar situations. In practice this points toward forms already available but marginal in most institutions: structured peer observation focused on judgement rather than technique, portfolios in which a teacher accounts for choices made under uncertainty, and the examination of how a colleague handled a genuinely novel demand rather than how well-established routines were executed.

The fourth consequence concerns the digital dimension specifically. The transformation described by Usman [20] multiplies available trajectories rather than accelerating movement along a single one, and it therefore increases the return on the meta-competence of self-direction while increasing the penalty for its absence. An institution that responds to abundant digital provision by mandating completion of parts of it has converted a resource into an instrument and has forfeited most of its value. An institution that responds by making the abundance available and doing nothing further will find that it has widened the gap between teachers who can navigate abundance and those who cannot. The productive response lies between: abundance made available, together with structured support for the activity of selecting within it.

The fifth concerns the collective dimension. Because the professional development of academic staff is coupled, each developing member alters the environment the others inhabit. These measures directed at the department may yield more than the same resources directed at individuals within it. Mukan's identification of leadership as a condition of effective development [4] is the clearest statement of this in the source base, and it is consistent with what a coupled process would predict. The corollary is that concentrating developmental investment in individuals identified as high-potential, a common institutional strategy, may be less efficient than distributing it in ways that raise the ambient quality of professional exchange, since the latter compounds and the former does not.

13. Limitations and Scholarly Positioning

The position advanced here stands in a determinate relation to the studies on which it draws, and stating that relation precisely guards against overstating the contribution. With respect to the five characteristics, the position is one of extension rather than divergence: the characteristics are those specified by Tkachenko [10] for pedagogical phenomena in general, and what is added is their systematic transfer to an object to which they had not previously been applied in a sustained manner. The philosophical grounding supplied by Panfilov and Romanova [7] and by Lisova [3], and the disciplinary substantiation offered by Vozniuk [2], are accepted rather than contested; the chapter demonstrates that academic staff development satisfies the conditions under which those general propositions hold.

With respect to the applied literature the relation is more substantive. Vahis [1] interprets the formation of professional competence as a synergetic process grounded in self-education, but the subject of that process is the student; the transfer to academic staff is not merely a change of population, since the teacher, unlike the student, simultaneously occupies the position of an element within the educational system and that of an agent who reconstructs it. Abd Hamid and colleagues [12] and Vathi and colleagues [21] address teachers, but as implementers of a synergetically organised process rather than as self-organising systems. Miao and colleagues [18] operate at the institutional level; the present analysis is situated at the level of the individual trajectory, and the two are complementary rather than competing.

With respect to the professional development literature the relation is one of supplementation. Guskey [15] and Antoniou and Kyriakides [13] identify conditionality and non-proportionality as empirical findings; what the synergetic framework adds is an account within which those findings are expected rather than anomalous. King [17], Bulvinska and Bulvinsky [14], Nicolau [19] and Wood and colleagues [22] document the range of forms professional development takes; the framework explains why the self-directed portion cannot be treated as a supplement to the organised portion. Odarchenko [6] supplies the closest thing to corroboration available within the source base, and the closeness of the fit requires care rather than celebration: that account was not designed to test synergetic propositions, and reading it as confirmation risks the retrospective fitting of evidence to

a framework it was not constructed to address. What may legitimately be claimed is that it is consistent with the synergetic model and difficult to accommodate within a strictly accumulative one.

There are three limitations of the study. It substantiates a methodological position without verifying it: the characteristics elaborated are analytical distinctions rather than measured constructs, and the relations posited among them are argued rather than demonstrated. The source base, though it spans Ukrainian and international scholarship, is weighted toward the former, which is appropriate to an argument concerned with the Ukrainian higher education context but limits the generalisability of the conclusions. And the institutional recommendations derived in the preceding section are consequences of the framework rather than findings; whether they improve outcomes in practice is an empirical question the study does not address. No claim is made regarding the frequency, duration or distribution of the phenomena described.

CONCLUSIONS

The study set out to substantiate the synergetic approach as a conceptual and methodological framework for the professional development of academic staff. Its results may be stated as five propositions.

First, the accumulative conception of professional development, as the incremental acquisition of specified content under external direction, evaluated by measuring delivery, retains its validity within a determinate jurisdiction and loses it beyond that jurisdiction. It remains appropriate to the formally regulated segment in which hours are certified, programmes accredited and qualifications documented, and in which the purpose is compliance. It fails where requirements are in motion and cannot be specified in advance, where change is discontinuous, where the developing subject rather than an external agent directs the process, and where outcomes stand in non-proportional relation to inputs. The chapter's argument is not that this conception should be abandoned but that its scope should be recognised.

Second, the reception of synergetics in educational scholarship has proceeded along philosophical, disciplinary and applied lines, and has produced substantial work in each, but has applied its apparatus almost exclusively to the educational process, the learning environment and the student. The teacher has appeared as the agent who arranges conditions

for self-organisation rather than as a self-organising system. Yet every condition for applying the apparatus to academic staff is satisfied: they exchange information with a professional environment across a permeable boundary, develop non-linearly, organise that development largely from within, pass through periods of instability at which trajectories diverge, and acquire qualities not reducible to their components.

Third, the five constitutive characteristics acquire specific content when transferred to this object. Openness is a bidirectional exchange in which the teacher both draws from and reconstitutes the professional environment, which makes development in a university a coupled rather than an individual process. Non-linearity accounts for the alternation of consolidation with rapid reorganisation and for the uniqueness of individual trajectories. Self-organisation identifies the teacher's own goal-setting, selection, integration and reflection as the leading mechanism, and repositions institutional provision as resource rather than instrument. Instability names those junctures at which established practice has been dismantled and its successor not yet built, and at which the further trajectory is genuinely open. Emergence explains the appearance of integrative qualities (pedagogical mastery, professional mobility, digital culture) that are constituted by relations among components and are therefore invisible to instruments that measure components.

Fourth, the characteristics operate as a mutually conditioning set, and the partial adoption of any one of them reproduces the limitations the approach was formulated to supersede. Openness without self-organisation yields exposure without integration; self-organisation without institutional tolerance of instability yields exploration that is corrected before it resolves; non-linearity acknowledged in principle but denied in evaluation yields an apparatus that measures what it can rather than what matters. The corollary for institutions is that adopting the position is not a matter of introducing a programme but of revising assumptions embedded in performance review, workload allocation, promotion criteria and quality assurance.

Fifth, three institutional consequences follow directly: the standardisation of provision has a limit beyond which further uniformity reduces effectiveness; responses to declining performance require differentiation, since a bifurcation point calls for time, dialogue and tolerance where a deficit calls for correction; and assessment built on competence inventories

systematically under-registers the qualities that matter most. To these may be added the observation that the digital abundance now available raises the return on the capacity for self-direction while raising the penalty for its absence, and that developmental investment directed at the collective may compound in ways that investment in selected individuals does not.

Prospects for further research follow from the limitations acknowledged above. The first and most pressing is empirical verification, and specifically the construction of instruments capable of registering emergent professional qualities through conduct in complex, unfamiliar situations rather than through inventories of discrete competences. The second is the reconstruction of individual professional trajectories, which would permit the posited alternation of consolidation and rapid change to be examined against observed data rather than against professional report. The third is the identification and description of bifurcation points in academic careers, together with the institutional conditions under which such points are resolved productively: work that would also supply the diagnostic criteria that the differentiation of institutional response requires. The fourth is the elaboration and comparative evaluation of institutional models of professional development consistent with the synergetic position, tested against conventional provision. The fifth, arising from the wartime evidence considered here, is the systematic study of professional development under conditions of institutional disruption, which offers an unusually direct view of self-organisation operating with the external layer removed.

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