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PEDAGOGICAL AND PSYCHOLOGICAL FEATURES OF DEVELOPING ECOLOGICAL CULTURE IN FUTURE AGRICULTURAL SPECIALISTS

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Abstract. Agricultural specialists make daily decisions about soil, water, chemicals and biodiversity, so the ecological culture of future agronomists, land managers and agricultural engineers directly shapes the sustainability of the sector. Higher education, however, often transfers ecological knowledge without developing the values, motivation and behavioral habits that turn knowledge into practice. This study identifies the pedagogical and psychological features of developing ecological culture in students of agricultural higher education institutions and tests an integrated educational model built on them. Ecological culture was assessed through cognitive, emotional-value, motivational and behavioral components using a questionnaire, a scale of environmental attitudes, a self-efficacy scale and a behavior checklist. The experimental group studied under a model combining problem-based learning, field practice, reflection and project work. After the intervention, the experimental group showed greater gains than the control group on all four components, with the largest differences in the emotional-value and behavioral components [exact values to be inserted]. Ecological culture develops effectively when cognitive instruction is combined with emotional engagement, autonomy-supportive teaching and authentic professional practice. The proposed model can be integrated into agricultural curricula.

Keywords: ecological culture; agricultural education; pedagogical psychology; environmental attitudes; sustainable agriculture; higher education

Introduction. Agriculture is both a major driver of environmental change and one of the sectors most exposed to its consequences. Soil degradation, salinization, water scarcity, pesticide overuse and loss of biodiversity are problems that future agricultural specialists will face throughout their careers. In Central Asia, where irrigated agriculture depends on limited water resources and land quality is under pressure, the need for ecologically competent professionals is especially acute.

Ecological culture is understood here as an integral personal quality that includes ecological knowledge, value-based attitudes toward nature, motivation for environmentally responsible activity and stable behavioral habits in professional and everyday life. This view is consistent with international frameworks that define learning for sustainability through cognitive, socio-emotional and behavioral learning dimensions (UNESCO, 2017).

Psychological research has long shown that knowledge alone does not guarantee pro-environmental behavior. The gap between awareness and action is explained by values, emotions,

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habits, social norms and perceived barriers (Kollmuss & Agyeman, 2002; Stern, 2000). Self-determination theory adds that behavior sustained by internal motivation is more durable than behavior driven by external pressure (Deci & Ryan, 2000), and social cognitive theory emphasizes the role of self-efficacy in turning intentions into action (Bandura, 1977). From the pedagogical side, experiential and transformative learning approaches argue that students change their frames of reference through real experience followed by critical reflection (Kolb, 1984; Mezirow, 1991).

Despite this, teaching of ecological topics in agricultural universities frequently remains lecture-based and informational, and psychological factors are rarely considered in course design. The research gap addressed in this article is the lack of an integrated model that links the psychological mechanisms of ecological culture with concrete pedagogical conditions in the training of agricultural specialists.

The aim of the study is to identify the pedagogical and psychological features of developing ecological culture in future agricultural specialists and to evaluate the effectiveness of a model based on them. The research questions are:

1. Which psychological components structure ecological culture in agricultural students?
2. Which pedagogical conditions most strongly support their development?
3. Does an integrated model produce measurable gains compared with traditional instruction?

2. Methods. A quasi-experimental pre-test/post-test design with an experimental group (EG) and a control group (CG) was used over one academic semester. Mixed methods were applied: quantitative measurement of the components of ecological culture and qualitative analysis of student reflections. Groups were comparable in age, gender distribution and baseline scores. Participation was voluntary, and informed consent was obtained.
Ecological culture was operationalized through four components:

Component	Content	Instrument
Cognitive	Knowledge of ecosystems, soil and water protection, sustainable practices	Knowledge test (30 items)
Emotional-value	Attitudes, empathy, sense of responsibility toward nature	Environmental attitudes scale (NEP-based; Dunlap & Van Liere, 1978)
Motivational	Intrinsic and extrinsic motives, self-efficacy	Motivation questionnaire (SDT-based) and self-efficacy scale
Behavioral	Resource-saving, waste handling, environmentally safe practice	Self-report behavior checklist and observation sheet during practice

Reliability of each instrument was checked using Cronbach's alpha (acceptable at $\alpha \geq 0.70$) [values to be inserted]. The CG followed the standard curriculum with lectures and laboratory sessions. The EG studied under an integrated model with four pedagogical conditions derived from the psychological analysis:

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1. **Problem-based and case learning.** Students analyzed real regional problems, such as soil salinity, irrigation efficiency and pesticide use.
2. **Field and practice-based learning.** Ecological assessment of fields and farms replaced part of the classroom work, linking theory with professional activity.
3. **Autonomy-supportive teaching and reflection.** Students chose project topics and kept reflective journals, supporting intrinsic motivation and critical reassessment of values.
4. **Collaborative project work.** Teams developed and presented ecologically sound solutions for a farm, building social norms and self-efficacy.

Data were processed with SPSS/Python. Normality was checked with the Shapiro–Wilk test. Between-group differences were assessed using the independent-samples t-test or the Mann–Whitney U test, and within-group changes using the paired t-test or Wilcoxon test. Effect sizes (Cohen's d) are reported, and significance was set at $p < 0.05$. Reflective journals were analyzed by thematic content analysis.

3. Results. At the pre-test, the groups did not differ significantly on any component ($p > 0.05$). In both groups, the cognitive component was the most developed, while the behavioral and motivational components were weaker, confirming the knowledge–action gap described in the literature [exact values to be inserted]. The EG improved significantly on all four components, whereas the CG improved mainly on the cognitive component. The largest between-group differences were found in the emotional-value and behavioral components [confirm with data]. Thematic analysis of reflective journals produced three recurrent themes: (a) a shift from viewing nature as a resource to viewing it as a system the specialist is responsible for; (b) increased confidence in applying ecological solutions in real farm conditions; and (c) the importance of seeing the consequences of agricultural practice in the field. [Illustrative student quotations to be added.]

4. Discussion

The findings, if confirmed by the collected data, are consistent with the view that ecological culture is a multicomponent personal formation rather than a body of knowledge. The modest gains of the control group in the cognitive component only reflect the limits of informational teaching, in line with the knowledge–behavior gap described by Kollmuss and Agyeman (2002).

From a psychological perspective, the strongest effects in the emotional-value and behavioral components can be explained by three mechanisms. First, autonomy-supportive conditions strengthened intrinsic motivation, as predicted by self-determination theory (Deci & Ryan, 2000). Second, successful completion of real field tasks raised self-efficacy, which supports the transition from intention to action (Bandura, 1977). Third, reflection on field experience allowed students to reconsider their values, in line with experiential and transformative learning (Kolb, 1984; Mezirow, 1991). From a pedagogical perspective, the results indicate that the context of the future profession is a powerful tool: agricultural students respond to ecological issues most strongly when these are linked to yields, farm economics and the long-term condition of land, rather than presented as abstract environmental content.

Practical implications. Agricultural curricula should (1) integrate ecological content into professional disciplines instead of isolating it in one course, (2) include field practice with ecological assessment, (3) use reflection and project work, and (4) monitor not only knowledge but also attitudes, motivation and behavior.

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Limitations. The study was conducted in a single institution over one semester, relied partly on self-reported behavior and used a quasi-experimental rather than fully randomized design. Long-term retention and transfer to professional practice require longitudinal follow-up.

5. Conclusion

Developing ecological culture in future agricultural specialists requires a pedagogical system that addresses its cognitive, emotional-value, motivational and behavioral components together. The key conditions are problem- and practice-oriented learning, support for students' autonomy, systematic reflection and collaborative project activity. The proposed integrated model is practical for agricultural higher education and can be adapted to other specialties. Further research should examine long-term effects and the role of regional and cultural factors.

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