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IMPROVING THE METHODOLOGY OF MORAL AND ETHICAL EDUCATION OF STUDENTS IN INFORMATICS LESSONS

Ahmadova Kamola Ahmad qizi
Email: kamolaahmadova22@gmail.com
https://orcid.org/0009-0004-4697-3294

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ABSTRACT

Informatics lessons are where school students first meet questions of privacy, authorship, online conduct and the fairness of automated systems, yet these questions are usually treated as technical rules rather than as moral learning. This paper proposes a methodology for integrating moral and ethical education into informatics lessons. The study follows an integrative literature review design combined with document analysis and conceptual modelling. The corpus comprised foundational works on moral development and character education, computer and information ethics, international frameworks on digital competence and digital citizenship, the ACM Code of Ethics and the UNESCO Recommendation on the Ethics of Artificial Intelligence, as well as the normative documents of the Republic of Uzbekistan on education and continuous spiritual education. Sources were coded deductively against Rest's four-component model of moral functioning. The analysis produced three results: (1) a map linking eight informatics content areas to the ethical issues and values they raise; (2) a five-component methodological model (target, content, methods, organisational conditions, assessment) built on six principles; and (3) a set of observable criteria and indicators for assessing students' ethical awareness, judgement, motivation and action in digital environments. The paper argues that

moral education in informatics is most effective when it is embedded in regular subject tasks rather than delivered as separate talks, and when it is assessed through students' decisions in realistic cases. The model is conceptual; its effectiveness should be tested in a pedagogical experiment.

1. Introduction.

Digital technologies have moved many everyday moral decisions into online spaces. School students decide whether to copy someone else's code or text, whether to share a classmate's photo, how to respond to an insulting message, and how far to trust the output of a search engine or an AI chatbot. These decisions are moral in nature, but they are made in technical settings that informatics lessons are meant to explain.

Moor (1985) described computer ethics as the analysis of the nature and social impact of computer technology and the formulation of policies for its ethical use. He argued that new technical possibilities create "policy vacuums" in which existing rules give no clear guidance. For a school student, such vacuums appear daily. Floridi (2013) later extended this view into a general ethics of information, in which privacy, ownership and the reliability of information are treated as moral matters in their own right.

International frameworks now name ethical conduct as part of digital competence. DigComp 2.2 includes netiquette, the protection of personal data and privacy, and the protection of health and well-being among the competences every citizen needs (Vuorikari et al., 2022). Ribble's (2015) model of digital citizenship lists nine elements, among them digital etiquette, digital law, and digital rights and responsibilities. The ACM Code of Ethics and Professional Conduct (Association for Computing Machinery [ACM], 2018) sets out principles such as avoiding harm, honesty, fairness and respect for privacy. UNESCO's (2021) Recommendation on the Ethics of Artificial Intelligence, adopted by 193 member states, calls for ethics to be built into education on AI.

In Uzbekistan, the Law "On Education" (Republic of Uzbekistan, 2020) and the Concept of Continuous Spiritual Education approved by Cabinet of Ministers Resolution No. 1059 of 31 December 2019 set the moral and spiritual upbringing of young people as a task for every stage and subject of education. Informatics is therefore expected to contribute to moral education, not only to technical skills.

Research on character education shows what such a contribution requires. Berkowitz and Bier (2007), reviewing 33 effective programmes, found that effective character education relies on interactive, student-centred strategies, an explicit focus on ethics, adult modelling and teacher professional development. Studies of digital citizenship confirm that respectful online behaviour and civic engagement can be defined and measured as outcomes (Jones & Mitchell,

2016), and that ethics is one of the core categories of digital citizenship alongside media literacy, participation and critical resistance (Choi, 2016).

Research gap. In practice, ethical topics in informatics lessons are often reduced to lists of rules ("do not share passwords", "do not download pirated software") presented at the end of a lesson. Such an approach transmits norms but does little to develop students' moral judgement or their motivation to act on it. What is missing is a subject-specific methodology that links informatics content to moral learning goals, specifies the methods and conditions for achieving them, and defines how the results can be assessed.

Aim and research questions. The aim of this paper is to develop and theoretically justify a methodology for the moral and ethical education of students in informatics lessons. The study addresses three questions:

1. Which ethical issues and values are inherent in the main content areas of school informatics?
2. What components, principles and methods should a methodology of moral education in informatics include?
3. By which criteria and indicators can the moral and ethical outcomes of informatics lessons be assessed?

2. Methods

The study is theoretical and uses an integrative literature review design (Torraco, 2005; Snyder, 2019) combined with document analysis and conceptual modelling. An integrative review is suited to topics where knowledge is spread across several fields and the goal is to synthesise it into a new framework rather than to estimate an effect size. Here, the relevant knowledge comes from moral psychology, character education, computer and information ethics, digital competence frameworks and national education policy.

Sources were selected purposively according to three criteria: (a) they are foundational or widely cited in their field; (b) they define concepts, principles or competences directly relevant to moral conduct in digital environments or to moral education in schools; and (c) their full text or official version was available for verification. The corpus was organised into five groups:

Group	Sources	Role in the analysis
Moral development and moral psychology	Kohlberg (1981); Rest (1986); Bandura (1999)	Stages and components of moral functioning; mechanisms of moral disengagement
Character education	Lickona (1991); Berkowitz & Bier (2007)	Effective practices and conditions of school moral education
Computer and information	Moor (1985); Floridi (2013); ACM (2018)	Ethical issues specific to computing and information

Group	Sources	Role in the analysis
ethics		
Digital competence and citizenship	Ribble (2015); Jones & Mitchell (2016); Choi (2016); Vuorikari et al. (2022); UNESCO (2021)	Ethical competences expected of digital citizens
National normative documents	Law "On Education" (2020); Cabinet of Ministers Resolution No. 1059 (2019)	Goals of moral and spiritual education in Uzbekistan

The analysis proceeded in three steps.

1. **Deductive coding.** Statements in each source describing ethical issues, values, competences or educational practices were coded against the four components of moral functioning proposed by Rest (1986): moral sensitivity (recognising that a situation has a moral dimension), moral judgement (deciding which action is right), moral motivation (giving priority to moral values) and moral character (persisting in acting on that decision).

2. **Thematic mapping.** Coded statements were grouped by the content areas of school informatics in which the corresponding situations arise, producing a map of content areas, ethical issues and values.

3. **Model construction.** The map and the evidence on effective character education were synthesised into a methodological model with a defined target, content, methods, organisational conditions and assessment criteria.

The resulting model is conceptual. Its internal consistency was checked by tracing every component back to at least one source in the corpus; its practical effectiveness was not tested in this study.

3. Results

3.1. Ethical issues and values in informatics content

Every major content area of school informatics contains recurring situations with a moral dimension. Table 1 links eight content areas to the ethical issues they raise, the values to be developed and the component of moral functioning (Rest, 1986) that a lesson on that topic can address most directly.

Table 1. Ethical issues and values in the content areas of school informatics

Informatics content area	Typical ethical issue	Values to be developed	Leading moral component
Information and its sources	Spreading unverified information; manipulation	Truthfulness, responsibility for shared content	Sensitivity, judgement
Text, image	Copying others' work;	Respect for	Sensitiv

Informatics content area	Typical ethical issue	Values to be developed	Leading moral component
and multimedia processing	editing photos of people without consent	authorship, respect for persons	ity
Algorithms and programming	Plagiarism of code; programs that may cause harm	Honesty, avoiding harm	Judgement, character
Networks and the Internet	Cyberbullying; rude online communication	Respect, empathy, tolerance	Motivation, character
Information security and personal data	Sharing others' data; weak protection of accounts	Privacy, trustworthiness, care	Sensitivity, character
Databases and spreadsheets	Collecting and using data about people	Confidentiality, fairness	Judgement
Software and licences	Pirated software; ignoring licence terms	Law-abidingness, fairness to creators	Judgement, motivation
Artificial intelligence and digital services	Presenting AI output as one's own; biased automated decisions	Academic honesty, fairness, human responsibility	Judgement

The map shows that moral education does not need extra lesson time: each content area already contains the situations through which moral sensitivity and judgement can be developed. It also shows that the issues are not limited to safety rules. Questions of authorship, fairness and human responsibility for automated decisions require reasoning, not only compliance.

3.2. The methodological model

The synthesis produced a model with five interrelated components (Figure 1).

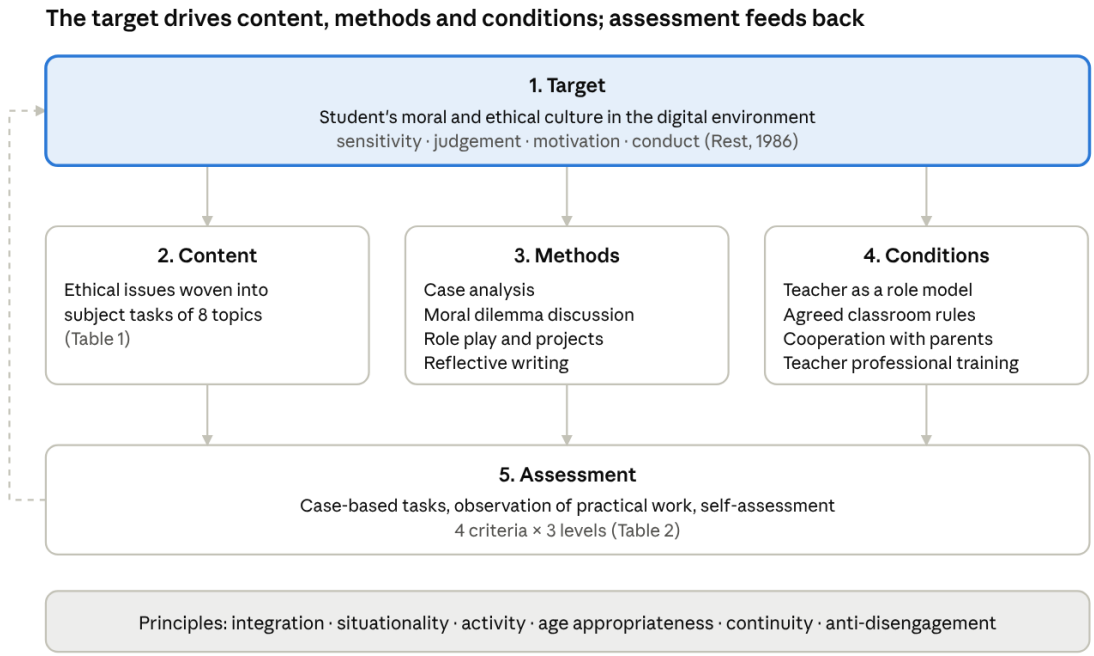

Figure 1. Methodological model of moral and ethical education in informatics lessons

Figure 1. The target sets the content, methods and organisational conditions; assessment results feed back into the target (dashed line), and six principles underpin the whole model.

Target component. The target is the formation of the student's moral and ethical culture in the digital environment, defined through Rest's four components: recognising moral aspects of digital situations, making reasoned decisions about them, valuing moral conduct and acting on it consistently.

Content component. Content is built on the map in Table 1. Ethical material is not added as a separate block; it is woven into the subject tasks of each content area. For example, a programming task includes a decision about reusing someone else's code, and a spreadsheet task uses a data set that raises a question of privacy.

Methods component. The methods follow the evidence that interactive, student-centred strategies are the most effective in character education (Berkowitz & Bier, 2007):

- case analysis of realistic digital situations (a leaked photo, a copied project, a biased algorithm);
- moral dilemma discussion in small groups, following the tradition of Kohlberg (1981), with students arguing for different courses of action;
- role play of online communication, including the roles of victim, bystander and moderator in cyberbullying situations;
- project work producing a useful digital product, such as a class guide to safe passwords or a poster on respectful chat rules;

• reflective writing at the end of a lesson, in which students record a decision they would make and why.

Organisational conditions. Four conditions support the model: the teacher acts as a model of ethical digital behaviour (Lickona, 1991); classroom rules for using devices and the Internet are agreed with students rather than imposed; cooperation with parents and the school's spiritual and educational staff; and professional development of informatics teachers in moral education methods.

Assessment component. Results are assessed through students' decisions and justifications in cases, observation of their conduct during practical work and self-assessment, using the criteria in Section 3.4.

3.3. Principles of the methodology

Six principles connect the components:

1. **Integration** — ethical content is embedded in subject tasks, not separated from them.
2. **Situationality** — learning is organised around realistic digital situations familiar to students.
3. **Activity** — students reach moral conclusions through discussion, decisions and projects rather than receiving them ready-made.
4. **Age appropriateness** — cases and the depth of reasoning are matched to students' level of moral development.
5. **Continuity** — ethical themes return in each grade at a deeper level, in line with the Concept of Continuous Spiritual Education (Cabinet of Ministers, 2019).
6. **Prevention of moral disengagement** — lessons explicitly address the self-justifications people use to excuse harmful online behaviour, such as "everyone does it" or "it is only a joke" (Bandura, 1999).

3.4. Assessment criteria and indicators

The four components of moral functioning provide the criteria. Each criterion is described at three levels so that teachers can assess students through observable behaviour (Table 2).

Table 2. Criteria and indicators of moral and ethical outcomes in informatics lessons

Criterion	Low level	Medium level	High level
Ethical sensitivity	Does not notice moral aspects of a digital situation	Notices them when prompted by the teacher	Identifies moral aspects independently and names who may be affected
Ethical judgement	Chooses an action without justification	Justifies the choice by a rule or by personal benefit	Justifies the choice by values, consequences for others and legal norms

Criterion	Low level	Medium level	High level
Ethical motivation	Shows indifference to the moral side of tasks	Follows ethical norms when supervised	Gives priority to ethical norms even when they are inconvenient
Ethical conduct	Violates norms in practical work (copying, rude messages)	Follows norms inconsistently	Consistently follows norms and supports others in doing so

The indicators can be gathered through case-based tests with open answers, structured observation during practical work, and student self-assessment questionnaires. Together, these instruments allow both the knowledge-based and the behavioural sides of moral education to be assessed.

4. Discussion

The first research question asked which ethical issues are inherent in school informatics. The map in Table 1 shows that they occur in every content area and that most of them correspond to the concerns of computer ethics identified by Moor (1985) and Floridi (2013): new technical possibilities without settled rules, and the moral status of information itself. This supports the view that informatics is not a neutral subject to which moral education must be attached from outside; moral questions are already part of its content.

The second question concerned the structure of the methodology. The proposed model agrees with the elements of effective character education identified by Berkowitz and Bier (2007). Interactive methods, an explicit focus on ethics, adult modelling and teacher professional development all appear in the model. The model adds what general character education programmes lack: subject-specific situations through which these elements can be realised in informatics. It also aligns with the ethics dimension of digital citizenship described by Choi (2016) and with the netiquette and privacy competences of DigComp 2.2 (Vuorikari et al., 2022), which makes the outcomes comparable with international frameworks.

The third question concerned assessment. Using Rest's (1986) four components as criteria separates two outcomes that rule-based instruction often confuses: knowing a norm and acting on it. A student may correctly state that copying code is wrong and still copy it under time pressure. Assessing moral motivation and conduct through observation of practical work, and not only through answers to questions, makes this gap visible. The emphasis on moral disengagement (Bandura, 1999) is relevant here, because online settings make it easier to excuse harmful acts through anonymity and diffusion of responsibility.

Practical implications. For informatics teachers, the model offers a way to pursue moral education without extra lesson hours: each topic in the curriculum can be paired with one realistic case and one decision task. For teacher education, it identifies the competences

informatics teachers need beyond technical knowledge, including leading a dilemma discussion and assessing students' reasoning.

Limitations. The study is theoretical. The selection of sources was purposive and may omit relevant regional research published in Uzbek or Russian. The content map and the criteria were derived from the literature and have not yet been validated by expert review or classroom data. The model also assumes a level of teacher preparation that may not be present in all schools.

Future research. The next step is a pedagogical experiment with control and experimental groups to test whether lessons designed according to the model lead to higher levels of ethical sensitivity, judgement, motivation and conduct. The assessment criteria in Table 2 should be operationalised into a validated instrument, and expert review of the content map by informatics teachers and specialists in moral education is recommended.

5. Conclusion

Informatics lessons contain a large and underused potential for moral and ethical education. Every content area of the subject — from information sources and programming to personal data and artificial intelligence — involves situations that require moral sensitivity and judgement.

This paper proposed a methodology that realises this potential through a five-component model: a target defined by the four components of moral functioning, content integrated into subject tasks, interactive methods (cases, dilemma discussions, role play, projects and reflection), supportive organisational conditions, and criteria with observable indicators for assessment. Six principles — integration, situationality, activity, age appropriateness, continuity and prevention of moral disengagement — connect these components.

The model is consistent with international evidence on character education, with digital competence and digital citizenship frameworks, and with the goals of continuous spiritual education in Uzbekistan. Its effectiveness should now be tested empirically in secondary school informatics classes.

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