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Identifying the Components of a Cyber Ethics Curriculum Model for Lower Secondary School Students

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A B S T R A C T

Purpose: This study aimed to identify and organize the components of a cyber ethics curriculum model for lower secondary school students based on the ten interconnected elements of Akker's Spider Web Curriculum Model.

Methods and Materials: This study employed a purely qualitative, exploratory-developmental design. Data were obtained through documentary analysis and in-depth semi-structured interviews with 18 participants selected through criterion-based purposive sampling supplemented by snowball sampling. Participants represented curriculum studies and educational sciences, educational technology and digital literacy, applied ethics and technology ethics, and lower secondary school teaching and administration, with relevant professional experience ranging from approximately 8 to 19 years. Data collection continued until thematic saturation was achieved. The interview protocol addressed the rationale, objectives, content, learning activities, teacher role, materials and resources, grouping, location, time, and assessment of cyber ethics education. Documentary and interview data were analyzed through thematic analysis using MAXQDA. Initial codes were generated from meaning units, conceptually related codes were organized into subthemes and major themes, and the resulting themes were subsequently mapped onto Akker's ten curriculum elements. Credibility, dependability, confirmability, and transferability were strengthened through member checking, comparison of documentary and interview evidence, expert review of coding, reflexive documentation, and maintenance of an audit trail.

Findings: The analysis yielded ten interrelated thematic domains: responsible digital citizenship, ethical interaction and mutual respect, privacy and data protection, ethical judgment and decision-making, digital safety and care, active and situated learning, teacher guidance and facilitation, developmental and implementation appropriateness, multidimensional assessment, and supportive learning resources and environments. These themes were integrated within Akker's ten curriculum elements. The final model emphasized responsible digital citizenship as the overarching rationale; cognitive, attitudinal, and behavioral objectives; content related to digital identity, privacy, consent, information credibility, safety, and ethical conflict; scenario-based and collaborative learning; facilitative teacher roles; credible and age-appropriate resources; flexible grouping; safe physical and digital environments; gradual and reflective time organization; and multidimensional, performance-oriented assessment.

Conclusion: The findings indicate that cyber ethics education for lower secondary students requires a coherent curriculum architecture in which ethical knowledge,

reasoning, responsible behavior, instructional processes, learning conditions, and assessment are systematically aligned rather than taught as disconnected digital rules.
Keywords: *Cyber Ethics, Curriculum Model, Lower Secondary Education, Digital Citizenship, Akker's Spider Web Model, Thematic Analysis*

1. Introduction

The rapid expansion of digital technologies has transformed the social, educational, and communicative environments in which adolescents learn, interact, construct identities, and participate in everyday life. Digital platforms are no longer peripheral tools for accessing information; rather, they constitute major spaces for interpersonal communication, educational participation, self-expression, collaboration, entertainment, and civic engagement. This transformation has created significant educational opportunities while simultaneously introducing complex ethical questions related to privacy, digital identity, respectful communication, information credibility, intellectual property, cyberbullying, online consent, security, responsibility, and the consequences of digital actions. As a result, contemporary education is increasingly expected to prepare students not merely to use digital technologies competently, but also to participate in digital environments in informed, responsible, critical, and ethically defensible ways. Research on digital citizenship has similarly emphasized that awareness of digital practices must extend beyond technical access toward responsible participation, appropriate conduct, and understanding of rights and responsibilities in technology-mediated environments (Hawamdeh et al., 2022; Saleh & Solihin, 2023).

For students in lower secondary education, these issues are particularly important because early adolescence represents a developmental period characterized by growing independence, intensified peer relationships, expanding use of social and digital media, and increased opportunities for autonomous decision-making. Students at this stage are often required to make rapid judgments concerning what to share, whom to trust, how to respond to disagreement, how to protect personal information, and how to interpret digital content. Such decisions have ethical as well as technical dimensions. Digital competence therefore cannot be understood solely as proficiency in operating devices, applications, or platforms. Comparative analyses of curricula have increasingly conceptualized digital competence as a multidimensional educational construct incorporating knowledge, skills, responsible participation, and context-sensitive use of digital tools (Kontkanen et al., 2023). Similarly, scholarship addressing computing and cybersecurity education has demonstrated that curricula must accommodate not only technical knowledge but also broader social, human, and educational considerations if learners are to participate effectively and responsibly in technologically mediated environments (Barendsen & Saeli, 2023; Yusuf, 2024).

The concept of cyber ethics provides an important educational lens through which these challenges can be addressed. Cyber ethics concerns the principles, judgments, responsibilities, and behavioral standards that guide human action in digital environments. In school education, it may encompass such issues as protection of personal and others' information, respectful online communication, responsible sharing of digital content, awareness of digital footprints, ethical use of information, prevention of online harm, appropriate responses to risky situations, and reflection on the social consequences of technological behavior. These dimensions overlap with digital citizenship but place particular emphasis on ethical reasoning and responsible action. The need for such an orientation is reinforced by studies indicating that digital literacy initiatives can influence students' character-related practices and engagement with cyberspace, yet digital programs may remain insufficient when ethical behavior is treated as an implicit consequence of technological literacy rather than as an explicit curricular concern (Saleh & Solihin, 2023). Moreover, research on cybersecurity education increasingly highlights the necessity of human-centered and inclusive approaches that recognize diverse learners, social contexts, and barriers to meaningful engagement rather than reducing the field to technical content alone (Arachchilage et al., 2026).

A central challenge, therefore, lies in translating broad ethical aspirations into a coherent curriculum. Curriculum development requires decisions about what learners should achieve, what content should be selected, how learning should occur, what role teachers should play, which

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resources should be used, how learners should be organized, where and when learning should take place, and how outcomes should be assessed. Curriculum research has consistently shown that isolated attention to content does not guarantee meaningful learning. Instead, alignment among objectives, learning experiences, pedagogy, assessment, and implementation conditions is required. Teachers themselves also function as curriculum designers and need knowledge that enables them to interpret curricular intentions, select appropriate content, adapt learning activities, and connect formal curriculum goals to actual classroom contexts (Almeida & Viana, 2022). This is especially relevant for cyber ethics, where teaching may involve sensitive personal experiences, rapidly evolving technologies, ambiguous moral dilemmas, and situations for which fixed answers may not always be adequate.

The importance of systematic curriculum design has been demonstrated across diverse educational fields. Curriculum innovation becomes more sustainable when design decisions are developed through iterative inquiry, contextual analysis, and participation of educational stakeholders rather than through the simple introduction of new content (Rumiantsev et al., 2026). Similarly, educational reforms are more likely to achieve ownership and sustained implementation when educators meaningfully engage with curricular structures and understand their underlying rationale (Osei-Tutu et al., 2025). Studies of learning pathways further indicate that curriculum design elements influence learners' progression and educational experiences and should therefore be examined as interconnected features rather than independent variables (Biemans et al., 2024). These findings are highly relevant to cyber ethics because the effectiveness of such a curriculum depends not only on identifying ethical themes but also on determining how these themes can be translated into age-appropriate, teachable, and assessable educational experiences.

Contemporary curriculum scholarship also emphasizes competence-oriented approaches that integrate knowledge with communication, critical thinking, collaboration, creativity, citizenship, and other capabilities necessary for participation in complex societies. Competence-based curriculum design has been associated with broader educational goals related to sustainability and the preparation of learners for multidimensional future demands (Bai & Liu, 2025). In vocational and professional education, rapid technological transformation has similarly intensified the need to align curricula with changing forms of human capital, digital competence, and new workplace expectations (Antonazzo & Peters, 2026). Although lower secondary education differs substantially from vocational education, the underlying implication is comparable: curricula must respond to changing technological realities by developing capabilities that go beyond factual knowledge. In cyber ethics education, such capabilities include the ability to interpret situations, anticipate consequences, justify choices, respect others, manage risk, and act responsibly in digital settings.

The importance of curriculum relevance is also evident in studies emphasizing the integration of learners' contexts, experiences, and cultures into educational materials. Locally meaningful learning resources can increase the relevance of curriculum content by linking formal instruction to students' lived environments (Nica et al., 2021; Oktarina et al., 2022). Curriculum materials that incorporate higher-order thinking similarly encourage learners to move beyond recall toward interpretation, evaluation, and application (Irnansyah et al., 2022). Digital educational games and interactive media further demonstrate that learning resources can be designed to support engagement when they are aligned with educational objectives and learner characteristics (Crisdiana, 2021; Supandhi et al., 2022). For cyber ethics, these principles suggest that abstract instruction about appropriate behavior may be insufficient. Students may benefit more from realistic scenarios, case-based tasks, digital dilemmas, collaborative analysis, and opportunities to explain the reasoning behind their decisions.

The development of responsible participation also requires attention to student agency. Curriculum research increasingly recognizes students as active participants in learning rather than passive recipients of predetermined content. Curriculum guidelines that support student agency emphasize opportunities for choice, reflection, responsibility, and meaningful participation in learning processes (Schoots-Snijder et al., 2025). Student voice has likewise been associated with motivation and more meaningful engagement in educational change when learners have opportunities to contribute to classroom processes and articulate their perspectives (Strating et al., 2025). This perspective is particularly significant in cyber ethics education because ethical competence cannot be developed solely through compliance with externally imposed rules. Students need opportunities to reason about dilemmas, examine alternative courses of action, consider the perspectives of others, and gradually assume responsibility for their own digital decisions.

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Such an approach also requires carefully designed interaction. Research on oral language learning demonstrates that teachers and students may perceive the purposes and enactment of classroom interaction differently, suggesting that instructional intentions must be translated clearly into learning experiences (Wurth et al., 2022). Studies of personal and social development similarly show that educational goals such as responsibility, cooperation, respect, and social competence require explicit pedagogical operationalization rather than general statements of intent (Opstoel et al., 2022). The distinction between intended and enacted curriculum is especially important here. Teachers may endorse broad curricular goals while classroom implementation differs because of contextual constraints, pedagogical habits, or insufficient resources (Mthembu, 2022). Consequently, identifying the components of a cyber ethics curriculum requires attention not only to desirable ethical outcomes but also to the practical conditions under which those outcomes can be taught.

Assessment constitutes another essential dimension. Ethical learning is difficult to capture through conventional knowledge tests alone because students may be able to define privacy, responsibility, or respectful communication without applying these principles in realistic situations. Broader assessment scholarship supports the use of multifaceted and collaboratively designed assessment systems when educational objectives involve complex competencies (Erickson et al., 2022). Research on curriculum and student development also suggests that curricular goals, content integration, and learner outcomes are interrelated and should be evaluated in ways that reflect these relationships (Vietze et al., 2022). Even in fields such as tax literacy, conceptual clarity concerning what learners are expected to know and do is necessary before meaningful educational assessment can be developed (Clercq, 2021). In cyber ethics, this implies a need for assessment approaches capable of examining students' reasoning, decision-making, application of principles, and observable conduct alongside conceptual knowledge.

A comprehensive curriculum framework is therefore necessary to integrate these multiple dimensions. Van den Akker's Spider Web Model provides a particularly relevant structure because it conceptualizes curriculum through ten interdependent elements: rationale, aims and objectives, content, learning activities, teacher role, materials and resources, grouping, location, time, and assessment. The model emphasizes that weakness or inconsistency in one element can affect the coherence of the entire curriculum. Recent work has demonstrated the practical applicability of the Spider Web Model for systematic curriculum design and has shown how the framework can guide educators in connecting educational rationale with learning goals, content, pedagogy, implementation, and assessment (Korkmaz, 2026). Applications of the model in other educational contexts have likewise demonstrated its value in identifying curriculum elements and revealing relationships among intended educational purposes, instructional structures, and implementation conditions (Makumane & Ngcobo, 2021; tajari, 2021).

The model is particularly appropriate for cyber ethics because this field cannot be reduced to one curriculum component. For example, identifying privacy as important content is insufficient unless corresponding objectives clarify what students should be able to recognize or do, learning activities allow them to practice decisions involving personal data, teachers are prepared to facilitate discussion, resources avoid exposing sensitive information, and assessment determines whether students can apply privacy principles in realistic situations. Similarly, respectful online interaction requires not only knowledge of communication rules but also opportunities for dialogue, peer collaboration, teacher modeling, appropriate grouping, sufficient time for reflection, and assessment of both reasoning and behavior. The Spider Web Model therefore offers a means of preserving coherence among the ethical, pedagogical, organizational, and evaluative dimensions of curriculum design.

Curriculum coherence is also relevant because educational programs often contain discrepancies between intended goals and what is actually emphasized or omitted. Analyses of the null curriculum have shown that examining what is absent from formal curricula can be as important as analyzing stated objectives and content (Tatar & Adıgüzel, 2022). In technology-related education, ethical issues may be especially vulnerable to such omission when curricular attention concentrates on digital skills, productivity, or technical safety while questions of responsibility, respect, consent, moral judgment, and social consequences remain fragmented or implicit. Comparative curriculum studies likewise demonstrate that educational systems may differ considerably in how they conceptualize and embed competencies, reinforcing the importance of explicit curriculum mapping and systematic integration (Havu-Nuutinen et al., 2021; Kontkanen et al., 2023). Curriculum mapping has also been proposed as a mechanism for improving integration and identifying relationships among

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learning domains that might otherwise remain disconnected (Zeynali-Tazehkandi et al., 2024).

The need for integration becomes more evident in educational contexts shaped by rapid technological and social change. Civic and citizenship-oriented education increasingly intersects with data, digital technologies, and new forms of participation. Research has shown that even younger students can engage with citizenship-related concepts through data-rich learning experiences when appropriate pedagogical structures are provided (Makar et al., 2023). Civic education curricula have also been redesigned in response to the demands of the Fourth Industrial Revolution, with increased attention to competencies needed for participation in changing social and technological environments (Nugraha et al., 2023). These trends indicate that cyber ethics should not be considered an isolated technology topic but as part of the broader educational responsibility to prepare students for citizenship in societies where digital and physical life are increasingly intertwined.

At the same time, curriculum development must remain attentive to contextual and epistemological questions. Curriculum is never merely a neutral selection of knowledge; it reflects assumptions about what forms of knowledge, experience, identity, and participation are valued. Research on curriculum decolonization emphasizes the need to examine whose experiences and knowledge are represented and how educators adapt curricular practices to contextual realities (Mbhele et al., 2024). Related scholarship has shown that superficially incorporating community-oriented or socially responsive themes without genuine epistemological integration can lead to tokenistic curriculum practices (Chandrasoma, 2021). For cyber ethics education, this means that imported lists of digital rules or international standards may be insufficient unless they are interpreted in relation to students' developmental characteristics, school environments, cultural expectations, and lived digital experiences.

Another significant issue concerns the relationship between curriculum design and educational feasibility. Curriculum innovation must account for available resources, teacher capacities, instructional time, school infrastructure, and the realities of implementation. A theoretically comprehensive curriculum that cannot be enacted meaningfully is unlikely to produce sustainable educational outcomes. Studies of curriculum implementation repeatedly demonstrate that teachers mediate formal curricular intentions through their professional judgment and contextual constraints (Almeida & Viana, 2022; Osei-Tutu et al., 2025). Curriculum planning for cyber ethics therefore requires the inclusion of practical components such as teacher guidance, adaptable learning resources, flexible grouping, safe learning environments, appropriate time allocation, and feasible forms of assessment. These concerns also support the use of qualitative inquiry because expert perspectives can reveal implementation requirements that may not be visible through document analysis alone.

Despite growing attention to digital literacy, cybersecurity, digital citizenship, and technology-supported learning, a conceptual gap remains between teaching students how to use digital technologies and designing a coherent curriculum that explicitly develops ethical digital judgment and behavior. Existing literature offers valuable insights into digital competence, curriculum design, student agency, learning materials, assessment, citizenship, and cybersecurity, but these strands are often examined separately. Furthermore, there remains a need to identify how the different dimensions of cyber ethics can be translated into a coordinated curriculum specifically suited to lower secondary students. A coherent model should clarify why cyber ethics is taught, what competencies students should acquire, which concepts should be included, what learning experiences are appropriate, how teachers should facilitate learning, which materials and environments are suitable, how students should be grouped, how learning should be temporally organized, and how achievement should be evaluated. Without such integration, cyber ethics education risks becoming fragmented, reactive, or restricted to occasional warnings about online danger rather than functioning as a developmental curriculum for responsible digital participation.

Accordingly, the present study aimed to identify and organize the components of a cyber ethics curriculum model for lower secondary school students within the ten interconnected elements of Akker's Spider Web Curriculum Model.

2. Methods and Materials

The present study employed a purely qualitative research design aimed at identifying and conceptualizing the components of a cyber ethics curriculum model for lower secondary school students. The qualitative approach was selected because the phenomenon under investigation involves multidimensional educational, ethical, technological, and curricular concepts that require an in-

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depth exploration of expert knowledge, professional experience, contextual understanding, and interpretations of cyber ethics within the school environment. The study was developmental and exploratory in orientation and sought to generate a contextually grounded curriculum framework rather than to test predetermined relationships among variables. The conceptual organization of the proposed curriculum was informed by Akker's Spider Web Curriculum Model, which conceptualizes curriculum as an interconnected system consisting of ten elements: rationale, aims and objectives, content, learning activities, teacher role, materials and resources, grouping, location, time, and assessment. In the present study, however, Akker's model was used as an organizing framework rather than as a restrictive deductive framework for generating qualitative data. Accordingly, concepts and themes were initially identified from documentary evidence and participants' accounts, after which the resulting themes were interpreted and organized in relation to the ten curriculum elements.

The study was conducted through two complementary qualitative sources of evidence: documentary analysis and semi-structured expert interviews. Documentary analysis was undertaken to identify established concepts, principles, educational priorities, competencies, and international experiences concerning cyber ethics, digital citizenship, responsible technology use, digital rights and responsibilities, online communication, privacy, security, digital well-being, and ethical participation in technology-mediated environments. These documentary findings provided an initial conceptual orientation for the fieldwork and informed the development of the interview protocol. The field component consisted of in-depth semi-structured interviews with individuals possessing relevant academic expertise or practical experience in curriculum studies, educational technology and digital literacy, applied ethics and technology ethics, educational psychology, school administration, and lower secondary education. Combining documentary evidence with expert interviews enabled the study to examine cyber ethics both at the conceptual level and within the realities of school education.

Participants were selected using criterion-based purposive sampling. Snowball sampling was subsequently employed when necessary to identify additional information-rich participants recommended by initial interviewees because of their specialized expertise or professional experience. Eligibility criteria required participants to possess substantial knowledge of at least one of the domains central to the study, including curriculum planning, educational technology, digital education, technology ethics, adolescent education, school administration, or teaching in lower secondary schools. Participants were expected to have at least five years of relevant educational, academic, research, or professional experience. Academic participants generally held a master's or doctoral degree in a field related to education, curriculum studies, educational technology, information technology in education, philosophy or applied ethics, educational psychology, or educational administration. Professional experience, scholarly publications, participation in curriculum development, engagement with digital learning environments, or direct experience with students' digital behavior were also considered important indicators of information richness. Participation was voluntary and based on informed consent.

The final qualitative panel consisted of 18 participants representing four complementary areas of expertise. Five participants had backgrounds in curriculum studies, educational sciences, educational psychology, instructional design, or curriculum evaluation; five had expertise in educational technology, digital literacy, information technology, electronic learning, or responsible digital behavior; four specialized in applied ethics, philosophy of ethics, technology ethics, privacy, digital rights, and ethical responsibility; and four were teachers or school administrators with direct professional experience in lower secondary education. Their relevant professional experience ranged approximately from 8 to 19 years, thereby allowing the study to incorporate both theoretical expertise and school-based practical knowledge. Participant recruitment and interviewing continued until thematic saturation was achieved. Saturation was defined as the point at which additional interviews no longer produced substantively new codes, concepts, meanings, or themes relevant to the components of the cyber ethics curriculum. Rather than determining the sample size exclusively in advance, sampling was therefore guided by the informational adequacy of the collected data and the progressive stability of the emerging thematic structure.

Ethical principles were observed throughout the study. Participants received information regarding the purpose of the research, the voluntary nature of participation, the intended use of interview data, confidentiality procedures, and their right to withdraw from the study at any point without consequence. Informed consent was obtained before interviews were conducted or recorded. Identifying information was removed from transcripts, and participant

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codes were used during analysis and reporting. Audio files, transcripts, coding documents, analytic memos, and other research records were maintained securely and used exclusively for research purposes. Direct quotations, where used in the findings, were reported without personally identifying information. Institutional and educational permissions required for conducting the study were also obtained in accordance with applicable research procedures.

Data were collected using a documentary analysis form and an in-depth semi-structured interview protocol. The documentary analysis form was developed to support the systematic examination of scientific publications, educational frameworks, competency models, policy documents, international guidelines, and relevant educational resources addressing cyber ethics and related constructs. The documentary review focused particularly on concepts associated with responsible participation in digital environments, online rights and responsibilities, privacy, security, ethical communication, respect for intellectual property, responsible information sharing, digital identity, cyberbullying, responsible social media use, digital well-being, critical engagement with online information, and the ethical implications of emerging technologies. Documents were selected on the basis of their substantive relevance to the study objectives and their potential contribution to understanding curriculum content and educational requirements for lower secondary students. Relevant textual units were extracted, recorded, coded, and compared in order to identify recurrent concepts and preliminary thematic categories. The documentary analysis did not function as an independent quantitative content analysis; rather, it was used qualitatively to deepen conceptual understanding, inform the interview questions, and provide an additional source against which interview-derived themes could be interpreted.

The primary field-based data collection instrument was a semi-structured interview protocol developed specifically for the study. The protocol was informed by the theoretical literature, documentary analysis, research objectives, and the conceptual logic of Akker's Spider Web Model. The use of semi-structured interviewing provided sufficient consistency across interviews while allowing the researcher to pursue unanticipated but theoretically important issues raised by participants. The interview protocol contained broad questions and probing prompts concerning the rationale for teaching cyber ethics to lower secondary students, the competencies and educational outcomes expected from such instruction, appropriate curriculum content, suitable learning experiences, the responsibilities and competencies of teachers, relevant instructional resources, appropriate forms of student grouping and interaction, physical and virtual learning environments, organization of instructional time, and appropriate approaches to assessing students' ethical understanding and conduct in digital environments. These dimensions corresponded broadly with Akker's ten curriculum elements, although participants were encouraged to discuss issues freely and were not constrained to predetermined categories.

Typical interview questions explored participants' experiences with students' ethical behavior in online and technology-mediated settings, the most significant cyber-ethical challenges encountered among lower secondary students, the knowledge, values, attitudes, skills, and behavioral competencies necessary for responsible participation in digital environments, and the ways in which cyber ethics could be meaningfully incorporated into school curricula. Additional probes addressed such issues as privacy protection, respectful digital communication, digital responsibility, appropriate use of online information, intellectual property, cyberbullying, exposure to harmful content, digital identity, ethical decision-making, teacher modeling, collaborative learning, scenario-based instruction, authentic learning situations, and assessment of ethical behavior. Participants were also asked to identify contextual considerations that might influence implementation within lower secondary schools and to explain how the various elements of a cyber ethics curriculum should be interconnected.

Interviews were conducted individually in a setting suitable for open and confidential discussion. Most interviews were conducted face to face, while remote interviews were used when geographical or practical circumstances made in-person participation difficult. Each interview lasted approximately 30 to 60 minutes. With participants' informed consent, interviews were audio-recorded to preserve the completeness and accuracy of the data. Recordings were transcribed verbatim shortly after each interview so that emerging concepts could inform subsequent interviews and theoretical sampling decisions. The researcher also prepared field notes and analytic memos during and immediately following interviews to document contextual observations, preliminary interpretations, potentially significant statements, and emerging relationships among concepts. This iterative process allowed data collection and analysis to proceed concurrently and

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enabled later interviews to examine insufficiently developed themes in greater depth.

Several procedures were adopted to enhance the trustworthiness of the qualitative evidence. Credibility was strengthened through prolonged engagement with the research topic, the use of multiple qualitative data sources, continuous comparison between documentary evidence and interview data, and member checking. Where appropriate, transcripts, interpretive summaries, or selected preliminary codes were shared with participants to determine whether the researcher's interpretations adequately represented their intended meanings. Dependability was addressed by maintaining a systematic audit trail documenting the procedures used for participant selection, interview administration, transcription, coding, theme development, conceptual decisions, and revisions made during analysis. Parts of the coding structure and thematic interpretations were reviewed by independent specialists familiar with qualitative research and curriculum studies to examine consistency and analytical plausibility. Confirmability was enhanced by preserving raw transcripts, coding records, analytical memos, theme-development documents, and methodological decisions so that interpretations could be traced back to the original evidence. Reflexive notes were also maintained to help distinguish participants' meanings from the researcher's assumptions. Transferability was supported through detailed description of the study context, participant characteristics, fields of expertise, educational setting, and procedures used for generating the curriculum components, thereby allowing readers to evaluate the applicability of the findings to comparable educational environments.

The qualitative data were analyzed using thematic analysis, following the general analytical logic proposed by Braun and Clarke. Analysis was conducted iteratively rather than as a single post-data-collection procedure. Documentary materials, interview transcripts, field notes, and analytic memos constituted the primary qualitative corpus. MAXQDA was used to facilitate systematic data organization, coding, retrieval, comparison, memo writing, and the construction of thematic relationships. The software served as an organizational and analytical support environment; interpretation and theme development remained researcher-driven processes grounded in close reading and continuous comparison of the qualitative evidence.

The analytical process began with repeated reading of the documentary materials and interview transcripts to achieve immersion in the data and develop familiarity with participants' accounts. Audio recordings were revisited when necessary to clarify emphasis, contextual meaning, or ambiguous sections of the transcripts. Meaningful textual segments relevant to cyber ethics education and curriculum design were then identified and assigned initial codes. Coding was conducted at a sufficiently detailed level to preserve the nuances of participants' descriptions and to avoid prematurely reducing complex statements to broad predetermined categories. Codes captured explicit concepts as well as interpretive meanings concerning student competencies, ethical challenges, educational priorities, instructional practices, contextual requirements, teacher responsibilities, digital environments, and assessment approaches. Similar codes identified across different participants and documentary sources were continuously compared to identify areas of convergence, variation, and conceptual distinction.

Following initial coding, related codes were clustered into more abstract categories and preliminary subthemes. The analysis moved recursively between coded extracts, categories, entire transcripts, documentary sources, and emerging themes in order to determine whether the developing thematic structure adequately represented the breadth and depth of the data. Codes that overlapped conceptually were merged when justified, while codes reflecting distinct meanings were retained separately even when they were associated with the same broader curricular domain. Preliminary themes were reviewed for internal coherence and external distinctiveness, ensuring that each theme represented a meaningful organizing concept and that relationships among themes were theoretically interpretable. Themes were subsequently defined and named in a way that reflected both their substantive meaning and their relevance to cyber ethics curriculum development for lower secondary students.

The relationship between inductive and framework-informed analysis was carefully maintained throughout the coding process. The study did not begin by forcing all statements directly into Akker's ten elements. Instead, codes and themes were initially generated from the documentary and interview data, allowing unexpected concepts and context-specific concerns to emerge. After the principal themes and subthemes had been established, they were systematically examined in relation to Akker's Spider Web Model. This stage involved organizing the identified curriculum components under the ten interconnected elements of rationale, aims and objectives, content, learning

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activities, teacher role, materials and resources, grouping, location, time, and assessment. The rationale element captured the philosophical and educational justification for cyber ethics education; the aims and objectives element represented intended knowledge, attitudes, values, skills, competencies, and ethical dispositions; and the content element incorporated the substantive concepts, ethical issues, and digital challenges to be addressed. Learning activities encompassed pedagogical experiences through which students could practice ethical reasoning and responsible digital conduct, while the teacher-role component reflected instructional, facilitative, supervisory, and modeling responsibilities. Materials and resources included digital and non-digital instructional resources; grouping addressed the organization of individual and collaborative learning; location concerned the physical and virtual environments in which learning could occur; time referred to the scheduling, continuity, and curricular allocation of cyber ethics education; and assessment captured approaches to evaluating knowledge, ethical reasoning, attitudes, competencies, and observable responsible behavior.

The thematic analysis continued until the coding system and thematic structure became stable and further examination of the data did not materially alter the principal categories. Particular attention was paid to negative cases, divergent expert perspectives, and concepts appearing in only a limited number of interviews but carrying substantial theoretical or educational significance. Such cases were not automatically discarded on the basis of frequency because thematic importance in qualitative analysis was determined by conceptual relevance in addition to recurrence. Documentary and interview evidence were compared throughout the analysis to identify concepts supported across multiple sources and to determine whether international frameworks corresponded with, extended, or differed from the experiences of experts working within the educational context under study.

The final analytical stage involved integrating the main themes, subthemes, and constituent codes into a coherent qualitative curriculum model for cyber ethics education. Relationships among curriculum elements were examined rather than treating each component as an isolated category, consistent with the systemic logic of Akker's Spider Web Model. The resulting framework therefore represented an interconnected curriculum structure in which educational rationale informed the objectives, objectives guided the selection of content and learning activities, instructional approaches shaped the role of the teacher and the use of resources, and contextual elements such as grouping, learning environment, time, and assessment interacted with the overall curriculum design. The final model was reviewed conceptually against the original transcripts, documentary evidence, coding structure, and expert interpretations to ensure that each proposed curriculum component was demonstrably grounded in the qualitative evidence. Through this procedure, the study generated a systematically developed and context-sensitive set of components for a cyber ethics curriculum specifically intended for students in lower secondary education.

3. Findings and Results

The qualitative analysis of documentary evidence and semi-structured expert interviews resulted in a progressive process of open coding, thematic integration, and final organization of the identified components within Akker's ten-element Spider Web Curriculum Model. The analysis initially remained close to the meaning units contained in the qualitative data so that the emerging concepts would not be prematurely constrained by a predetermined curricular framework. Meaning units were condensed and reformulated, initial codes were generated, and conceptually related codes were subsequently clustered into broader categories. Through constant comparison of codes and themes, ten major thematic domains gradually emerged, including responsible digital citizenship, ethical interaction and mutual respect, privacy and data protection, ethical judgment and decision-making, digital safety and care, active and situated learning, teacher guidance and facilitation, developmental and implementation appropriateness, multidimensional assessment, and supportive learning resources and environments. Table 1 presents representative examples of the open-coding process and demonstrates how condensed meaning units were transformed into initial codes and core concepts.

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Table 1

Representative Open Coding of the Qualitative Data

No.	Reformulated Meaning Unit	Initial Code	Core Concept
1	Before sharing information, students consider the possible consequences for other people.	Assessing consequences of sharing	Digital responsibility
2	Students do not disclose their own or other individuals' personal information without permission.	Respecting privacy	Data protection
3	Disagreement in online communication should not result in humiliation, hostility, or harassment.	Respectful communication	Ethical interaction
4	Before reposting content, students examine its credibility and possible consequences.	Evaluation before reposting	Critical judgment
5	Password selection and security settings should reflect awareness of possible risks.	Safe digital action	Protection and security
6	When facing online conflict, students compare alternative courses of action before responding.	Comparing behavioral options	Ethical decision-making
7	Rather than supplying immediate answers, teachers guide students in examining the situation and reaching a reasoned judgment.	Facilitating judgment	Teacher guidance
8	Educational activities use situations that are understandable and relevant to adolescents.	Age-appropriate situations	Developmental appropriateness
9	During collaborative activities, students explain the reasons underlying their decisions.	Ethical reasoning	Collaborative learning
10	Assessment examines students' behavior and reasoning in addition to their theoretical knowledge.	Multidimensional assessment	Learning assessment

Table 1 illustrates that open coding was conducted at a relatively concrete and data-near level. Initial codes were formulated as brief conceptual labels that preserved the meaning of each analytical unit without immediately assigning it to one of Akker's curriculum elements. This procedure was important because premature allocation of qualitative evidence to a predefined curricular category could have limited the emergence of contextually meaningful themes. For example, "assessing consequences of sharing" reflected the broader concept of digital responsibility, whereas "respecting privacy" represented a conceptually distinct concern relating to data protection. Similarly, "comparing behavioral options" captured the deliberative dimension of ethical decision-making, while "facilitating judgment" represented the pedagogical role expected from the teacher. Constant comparison of such codes allowed conceptually similar meanings to be clustered while preserving distinctions between related but non-identical domains.

Following open coding, related codes were grouped into subthemes and broader themes, and the emerging thematic structure was subsequently examined in relation to the ten elements of Akker's Spider Web Model. The resulting organization demonstrated that the identified themes were distributed across all major curriculum dimensions rather than being restricted to curriculum content alone. The findings showed that cyber ethics education involved a coherent system of rationale, objectives, content, learning activities, teacher roles, educational resources, grouping arrangements, learning environments, temporal organization, and assessment procedures. Table 2 integrates the findings related to all ten curriculum elements and summarizes the most prominent themes, subthemes, and representative qualitative meanings associated with each element.

Table 2

Organization of the Identified Themes Across the Ten Elements of Akker's Curriculum Model

Akker Curriculum Element	Major Themes	Principal Subthemes	Representative Findings
Curriculum rationale	Responsible digital citizenship; ethical judgment and decision-making; ethical interaction; digital safety	Rights and responsibilities; social consequences; moral agency; respectful participation; balance between opportunities and risks	Cyber ethics should extend beyond technical competence and develop the capacity to connect personal digital choices with the rights of others, social consequences, responsible participation, and independent ethical judgment.
Aims and objectives	Digital responsibility; ethical interaction; privacy protection;	Recognizing sensitive information; explaining ethical reasons;	Students should be able to recognize sensitive information, assess consequences, explain reasons for their choices, interact respectfully, identify risky situations, seek

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	ethical decision-making; safety and care	comparing alternatives; responsible participation; help-seeking	appropriate support, and apply ethical principles in everyday digital situations.
Curriculum content	Digital citizenship; privacy and data protection; digital safety; ethical judgment	Digital identity; personal and sensitive data; consent; content credibility; cyberbullying; digital rights; online conflict	Content should cover digital identity, rights and responsibilities, privacy, consent, security, credibility of online information, respectful communication, harmful digital behavior, and analysis of ethical conflicts.
Learning activities	Active and situated learning; ethical judgment; collaborative learning	Case analysis; scenario analysis; group discussion; role play; problem solving; comparison of alternatives; reflection	Students should analyze authentic or age-appropriate scenarios, compare behavioral options, examine consequences for different stakeholders, participate in guided discussion, develop solutions, and reflect on their decisions.
Teacher role	Teacher guidance and facilitation; ethical modeling; supportive instruction	Questioning; reasoned feedback; discussion management; emotional safety; support in risky situations	Teachers should function as facilitators rather than mere transmitters of rules, encourage reasoning through purposeful questioning, model respectful conduct, provide evidence-based feedback, and intervene responsibly when students encounter risks.
Materials and resources	Supportive learning resources; critical digital literacy	Scenarios; authentic examples; safety guides; checklists; rubrics; credible sources	Educational resources should be age-appropriate, credible, culturally appropriate, ethically designed, free from unnecessary disclosure of personal information, and capable of supporting analysis, reasoning, and performance-based assessment.
Grouping	Collaborative learning; respectful interaction; individual accountability	Individual work; paired discussion; small-group learning; shared problem solving; equal participation	Grouping should vary according to the purpose of the activity. Individual analysis may support independent judgment, while paired or small-group activities can facilitate comparison of perspectives, respectful dialogue, and collaborative problem solving.
Location	Safe physical and digital learning environments	Classroom discussion space; secure digital environment; confidentiality; access to support	Learning environments should provide psychological, informational, and digital safety. Students should not be required to reveal personal accounts, private messages, or real sensitive information during educational activities.
Time	Gradual learning; practice and reinforcement; reflection	Time for reasoning; repeated practice; periodic review; feedback; progressive complexity	Ethical learning requires sufficient time for reflection, comparison of options, discussion, revision, repeated practice, and gradual progression from simple concepts to more complex digital dilemmas.
Assessment	Multidimensional assessment; performance-based evaluation	Knowledge; reasoning; attitude; observable behavior; self-assessment; transfer of learning	Assessment should examine not only knowledge of ethical principles but also reasoning, application, observable conduct, responsible decision-making, self-evaluation, and the ability to transfer learning to unfamiliar situations.

As shown in Table 2, the findings indicated that the cyber ethics curriculum should be understood as an interconnected educational system rather than as a collection of isolated digital rules. At the level of curriculum rationale, the dominant emphasis was on educating responsible digital citizens capable of connecting individual choices with rights, responsibilities, and social consequences. The objectives extended beyond knowledge acquisition and incorporated ethical reasoning, respectful interaction, privacy awareness, safe behavior, and help-seeking competence. The content domain included digital identity, privacy, consent, content credibility, online respect, cyber risks, and ethical conflict, while the learning process emphasized situated activities such as scenario analysis, discussion, comparison of alternatives, and problem solving. The role of the teacher was consistently characterized as facilitative and supportive, with particular emphasis on questioning, modeling, feedback, and protection in potentially harmful situations. The findings also showed that instructional materials, grouping, learning environments, and time allocation should be aligned with developmental needs and the ethical sensitivity of the topic. Finally, assessment was consistently described as multidimensional, requiring attention to knowledge, reasoning, attitudes, observable behavior, and students' ability to apply ethical principles in new situations.

The final stage of analysis involved synthesizing the thematic findings into a coherent set of curriculum components that could be directly used in the design of a cyber ethics curriculum for lower secondary school students. At this stage, the identified themes were refined, redundancies were reduced, conceptual boundaries were clarified, and each set of components was positioned within the corresponding element of Akker's model. The resulting structure retained the systemic nature of the Spider Web Model by emphasizing that no curriculum element operates independently. Table 3 presents the final identified components of the proposed cyber ethics curriculum.

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Table 3

Final Identified Components of the Cyber Ethics Curriculum Based on Akker's Model

Akker Element	Major Themes	Subthemes	Final Curriculum Components
Curriculum rationale	Responsible digital citizenship; ethical judgment	Rights and responsibilities; consequences of behavior; moral agency	Development of responsible digital citizens; connection of cyber ethics with everyday digital life; simultaneous attention to individual rights and social responsibility
Aims and objectives	Responsibility; ethical interaction; ethical judgment; safety	Identification of sensitive information; ethical reasoning; appropriate behavioral choice; help-seeking	Cognitive, attitudinal, and performance-oriented objectives; ability to explain ethical reasons; recognition of risks; protection of privacy; respectful digital interaction
Content	Digital citizenship; data protection; safety; ethical decision-making	Digital identity; personal data; consent; credibility of content; cyber harassment	Principles of cyber ethics; digital rights and responsibilities; privacy; security; content evaluation; management of ethical conflict
Learning activities	Active learning; judgment and decision-making	Case studies; scenario analysis; group discussion; role play; problem solving	Situated learning activities; comparison of alternatives; decision-making practice; consequence analysis; reflection and transfer of learning
Teacher role	Guidance; facilitation; ethical modeling	Questioning; feedback; discussion management; protection in risky situations	Teacher as guide and facilitator; modeling of ethical digital conduct; creation of a safe learning climate; provision of reasoned feedback and responsible support
Materials and resources	Supportive learning resources; critical literacy	Scenarios; educational examples; safety guides; checklists; rubrics	Credible and age-appropriate resources; ethical scenarios; practical guidance; performance-assessment tools; protection of confidentiality in instructional materials
Grouping	Collaborative learning; respectful participation	Individual activity; pair work; small-group learning; equal participation	Selection of grouping according to activity goals; clear distribution of roles; equal opportunities for reasoning; preservation of respect and confidentiality
Location	Safe learning environment; supportive physical and digital spaces	Classroom; educational digital environment; secure discussion space; access to support	Safe physical and digital environments; appropriate access to resources; protection of personal information; suitable spaces for participation and dialogue
Time	Gradual learning; consolidation; reflection	Reflection time; practice and repetition; review; opportunity for feedback	Time allocation proportional to task complexity; gradual sequencing of content; opportunities for reasoning and revision; periodic reinforcement of key concepts
Assessment	Multidimensional assessment; performance evaluation	Knowledge; reasoning; attitude; observable behavior; self-assessment	Alignment of assessment with objectives; scenario-based assessment; performance rubrics; observation of participation; formative feedback and self-assessment

Table 3 represents the final synthesized structure of the identified cyber ethics curriculum components. The findings demonstrate that the rationale establishes the overarching orientation of the curriculum by emphasizing responsible digital citizenship and ethically informed participation. The objectives translate this orientation into observable cognitive, attitudinal, and behavioral outcomes, while the content and learning activities provide the substantive and experiential basis through which these objectives can be achieved. Teacher guidance, appropriate resources, purposeful grouping, safe learning environments, and sufficient instructional time constitute the principal conditions for implementation. Assessment, in turn, provides evidence of whether students can move beyond recalling ethical rules toward analyzing situations, explaining reasons, selecting responsible actions, and reflecting on their own digital behavior. The findings further indicate that the ten elements should not be interpreted as independent categories. For example, the objective of ethical decision-making requires corresponding content on digital dilemmas, situated activities involving comparison of alternatives, teacher questioning that stimulates reasoning, adequate time for reflection, and assessment methods capable of examining both the selected decision and the rationale underlying it. The final model therefore reflects an integrated curriculum structure in which all ten elements mutually reinforce the development of responsible, respectful, safe, and ethically reasoned participation in digital environments.

4. Discussion and Conclusion

The present study identified the components of a cyber ethics curriculum for lower secondary school students and organized them within the ten interconnected elements of Akker's Spider Web Curriculum Model. The qualitative findings showed that cyber ethics education should not be treated as a narrow instructional topic concerned only with digital safety or technical behavior. Instead, the resulting

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model conceptualized cyber ethics as an integrated curricular domain incorporating responsible digital citizenship, ethical interaction and mutual respect, privacy and data protection, ethical judgment and decision-making, digital safety and care, active and situated learning, teacher guidance and facilitation, developmentally appropriate implementation, supportive learning resources and environments, and multidimensional assessment. These findings suggest that effective cyber ethics education requires coherence between why the curriculum is taught, what students are expected to learn, what content should be included, how learning should be organized, what teachers should do, which resources and environments are needed, and how learning should be assessed. This systemic interpretation is consistent with the central logic of Akker's model, which emphasizes that curriculum quality depends on the alignment and mutual support of interdependent elements rather than the isolated quality of any single component (Korkmaz, 2026; Makumane & Ngcobo, 2021; tajari, 2021).

One of the most important findings concerned the rationale of the curriculum, which was centered on the development of responsible digital citizenship and ethically informed participation in digital environments. The participants' views and documentary evidence indicated that students should be able to connect their individual digital choices with the rights of others, social consequences, responsibility, and moral agency. This finding moves cyber ethics beyond compliance with rules and positions it as part of broader citizenship education. Similar conclusions have been reported in studies emphasizing that digital environments influence character formation, citizenship practices, and students' participation in social life (Saleh & Solihin, 2023). Research on digital citizenship has also shown that awareness of digital practices includes responsible communication, appropriate conduct, understanding rights and obligations, and ethical participation rather than merely operational knowledge of technology (Hawamdeh et al., 2022). The present results therefore support the view that cyber ethics should be embedded in the broader educational mission of preparing students to participate responsibly in contemporary digital societies.

The identified curriculum objectives further reinforced this interpretation. The findings showed that expected learning outcomes should encompass cognitive, attitudinal, and behavioral dimensions. Students should be able to recognize sensitive information, explain the ethical basis of a decision, compare alternative actions, anticipate consequences, interact respectfully, recognize risky situations, and seek help when necessary. Such outcomes reflect a competence-based orientation rather than a content-transmission approach. This finding is consistent with the broader movement toward competence-oriented curricula that combine knowledge with communication, critical thinking, collaboration, judgment, and responsible participation (Bai & Liu, 2025). It also aligns with research emphasizing student agency as a central objective of contemporary curriculum design, particularly when students are expected to make meaningful choices and assume increasing responsibility for their own learning and conduct (Schoots-Snijder et al., 2025). In the context of cyber ethics, agency is particularly important because responsible digital behavior cannot be developed through memorization of rules alone; students must progressively learn to justify and regulate their own decisions.

The content identified in the present study included digital identity, privacy, personal and sensitive data, consent, credibility of online information, respectful communication, digital rights and responsibilities, cyberbullying, safety, and management of ethical conflict. This breadth demonstrates that cyber ethics occupies an interdisciplinary space connecting digital literacy, citizenship, critical thinking, security, social interaction, and moral education. The findings are consistent with comparative research showing that digital competence in educational curricula involves multiple dimensions and should be understood as more than technical proficiency (Kontkanen et al., 2023). They are also supported by literature on computing curricula, which argues that technological education should include human, social, ethical, and contextual dimensions alongside technical knowledge (Barendsen & Saeli, 2023). Similarly, calls to better align cybersecurity education with real-world needs suggest that curricula should combine technical awareness with broader capacities for responsible judgment and action (Yusuf, 2024). The present study extends this logic to lower secondary education by showing that students require age-appropriate opportunities to engage with ethical aspects of digital life before entering more advanced educational or professional contexts.

Another prominent finding related to learning activities. The participants emphasized case analysis, scenario-based learning, discussion, role play, problem solving, comparison of alternatives, reflection, and transfer of learning to everyday situations. This supports an active and situated conception of cyber ethics education in which students learn

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through engagement with meaningful dilemmas rather than through passive reception of abstract prescriptions. The finding is consistent with research showing that higher-order learning is strengthened when educational materials require learners to interpret, evaluate, and apply knowledge rather than merely reproduce information (Irnansyah et al., 2022). It also corresponds with studies showing that contextually relevant educational materials can enhance meaningful engagement by connecting curriculum content with learners' cultural and lived experiences (Nica et al., 2021; Oktarina et al., 2022). Interactive and game-based materials have similarly been shown to support engagement when they are aligned with learning goals and learner characteristics (Crisdiana, 2021; Supandhi et al., 2022). In cyber ethics education, such active methods are especially appropriate because ethical competence requires practice in recognizing dilemmas, evaluating competing considerations, and defending decisions.

The findings concerning the teacher's role were equally significant. Teachers were not conceptualized primarily as transmitters of correct answers, but as facilitators, guides, ethical role models, discussion managers, and providers of reasoned feedback. Participants emphasized that teachers should use questioning to stimulate judgment, model respectful behavior, create psychologically safe learning environments, and provide appropriate support when students encounter potentially harmful situations. These results align closely with scholarship portraying teachers as active curriculum designers who interpret curricular aims, adapt content, select learning experiences, and connect formal intentions with classroom realities (Almeida & Viana, 2022). They also correspond with evidence showing that curriculum implementation depends substantially on educators' engagement, ownership, and capacity to translate formal expectations into practice (Osei-Tutu et al., 2025). Moreover, research on teacher perceptions has demonstrated that intended educational goals may differ from what is actually enacted in classrooms, highlighting the importance of teacher understanding and pedagogical competence (Mthembu, 2022). The present study therefore suggests that successful implementation of cyber ethics education depends heavily on teachers' ability to facilitate ethical reasoning without reducing learning to rule enforcement.

The identified emphasis on respectful interaction, dialogue, and collaborative reasoning also supports the social dimension of cyber ethics learning. Students were expected to explain their views, listen to others, compare alternative interpretations, and participate respectfully in group discussions. These findings are consistent with studies emphasizing student voice and participation as important mechanisms for motivation and meaningful educational engagement (Strating et al., 2025). They also correspond with research demonstrating that personal and social development goals such as respect, cooperation, and responsibility must be translated into explicit pedagogical practices rather than remaining broad statements of educational intention (Opstoel et al., 2022). Research on classroom interaction likewise shows that learning goals involving oral communication and participation require careful alignment between teacher expectations and students' experiences (Wurth et al., 2022). In cyber ethics, this is particularly relevant because respectful digital interaction is best learned not only as content but also through classroom processes that model and rehearse the same principles.

The findings regarding materials and resources emphasized credibility, developmental appropriateness, cultural relevance, confidentiality, practical usefulness, and alignment with curriculum objectives. Participants particularly highlighted scenarios, authentic examples, safety guides, checklists, and performance rubrics. These findings are supported by research indicating that curriculum materials should be connected to learner context and should not remain detached from the experiences through which students interpret knowledge (Chandrasoma, 2021; Oktarina et al., 2022). The concern with contextual relevance is also consistent with scholarship that critiques tokenistic curriculum practices and calls for deeper integration of local knowledge and learner experience (Mbhele et al., 2024). The findings suggest that cyber ethics resources should therefore avoid simply importing generic digital rules without adaptation. Instead, examples and scenarios should be recognizable to students, culturally appropriate, and designed in ways that do not compromise privacy or expose real personal information.

The organization of grouping, location, and time further demonstrated that implementation conditions are integral to curriculum design. The findings indicated that individual work, pair activities, and small-group discussion should be selected according to the purpose of the task, while physical and digital learning environments should ensure safety, confidentiality, access to support, and opportunities for participation. Time should also be sufficient for reflection, discussion, practice, feedback, and gradual progression from basic concepts to more complex dilemmas. These findings are consistent with the broader principle that curriculum

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design requires attention to learning pathways and implementation structures rather than simply to subject matter (Biemans et al., 2024). They also reinforce the systemic nature of Akker's framework, in which organizational elements such as grouping, location, and time contribute directly to the feasibility and coherence of the curriculum (Korkmaz, 2026). The relevance of these elements is especially evident in cyber ethics because rushed discussion or unsafe learning environments may undermine students' willingness to disclose uncertainty, consider alternatives, or engage with sensitive digital experiences.

The assessment findings also deserve particular attention. Participants emphasized multidimensional evaluation involving knowledge, reasoning, attitudes, observable performance, self-assessment, and transfer of learning. This reflects an understanding that students may know ethical rules without necessarily being able to apply them. The finding is supported by assessment scholarship that advocates multifaceted approaches when educational outcomes include complex competencies rather than simple factual knowledge (Erickson et al., 2022). It also aligns with research showing that curriculum goals, content, and student outcomes should be considered together when evaluating educational effectiveness (Vietze et al., 2022). The importance of conceptual clarity in assessment has similarly been emphasized in literacy-related research, where determining what a competence actually means is a prerequisite for developing valid educational measures (Clercq, 2021). In the present study, this suggests that cyber ethics assessment should focus on how students reason through dilemmas, justify choices, recognize consequences, and apply ethical principles across different contexts.

The findings also reveal the importance of curriculum coherence and the avoidance of hidden or omitted dimensions. Although schools may address internet safety or digital skills, ethical dimensions such as consent, moral responsibility, respectful communication, or the social consequences of digital conduct can remain fragmented or implicit. Research on the null curriculum has shown that what is absent from formal curricula can significantly shape students' educational experiences (Tatar & Adıgüzel, 2022). The present results therefore suggest that cyber ethics should be made explicit rather than assumed to emerge automatically from technology education. Curriculum mapping can help address this problem by making relationships among objectives, content, activities, and outcomes visible and identifying gaps in curricular coverage (Zeynali-Tazehkandi et al., 2024). Comparative curriculum research likewise demonstrates that competencies can be differently distributed or emphasized across systems, strengthening the case for a deliberate and transparent approach to integration (Havu-Nuutinen et al., 2021).

The broader significance of the findings can also be understood in relation to technological and social transformation. Digital citizenship, data literacy, cybersecurity, and ethical participation increasingly overlap. Studies have shown that citizenship learning can be meaningfully connected with data-oriented educational activities even among younger learners (Makar et al., 2023), while curricular reform in the context of the Fourth Industrial Revolution has emphasized the need for new combinations of civic and technological competencies (Nugraha et al., 2023). At more advanced educational levels, technological transformation is also reshaping expectations regarding human capital, digital readiness, and professional education (Antonazzo & Peters, 2026). These developments support the present study's argument that cyber ethics education should begin before students reach higher education or the workplace. Lower secondary education represents an appropriate stage for systematically developing the habits of reasoning, responsibility, and digital participation that students will need in increasingly technology-mediated contexts.

The results also support an inclusive and human-centered conception of technology education. Recent work in cybersecurity education has emphasized the importance of inclusive curriculum design and attention to diverse learner experiences, structural barriers, and patterns of engagement (Arachchilage et al., 2026). The present study's emphasis on developmental appropriateness, safe participation, accessibility of resources, and contextualized learning is consistent with this perspective. Similarly, curriculum innovation is more sustainable when it emerges from careful design processes, stakeholder engagement, and iterative adaptation to educational settings (Rumiantsev et al., 2026). Accordingly, the proposed model should be understood not as a rigid prescription but as a coherent design framework that can be adapted to local school conditions while preserving the alignment among its ten components.

Overall, the findings demonstrate that cyber ethics education requires a curriculum architecture rather than a collection of disconnected topics. The ten identified elements operate as a coordinated system: the rationale defines the educational purpose; the objectives specify the intended competencies; the content identifies the relevant ethical and digital knowledge; the activities create

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opportunities for practice and reflection; the teacher role supports reasoning and safety; the resources provide appropriate learning stimuli; grouping structures social interaction; location and time create feasible conditions for implementation; and assessment determines whether students can apply ethical understanding in authentic situations. This integrated interpretation is consistent with the logic of the Spider Web Model and with curriculum scholarship emphasizing coherence, contextual responsiveness, learner agency, and sustainable implementation (Korkmaz, 2026; Rumiantsev et al., 2026; Schoots-Snijder et al., 2025). The study therefore contributes a qualitative, curriculum-centered framework for translating the broad concept of cyber ethics into an educational structure appropriate for lower secondary students.

The study has several limitations that should be considered when interpreting the findings. First, the results were generated through qualitative analysis of documentary sources and expert interviews, and therefore represent a contextually developed interpretation rather than a universally fixed set of curriculum components. The participants were selected because of their expertise in curriculum studies, educational technology, ethics, and lower secondary education, but other stakeholder groups, particularly students and parents, were not directly included. In addition, the final organization of the findings was guided by Akker's ten-element model after the initial coding process, which may have influenced how some themes were ultimately classified. The rapidly changing nature of digital technologies also means that specific ethical concerns, platforms, risks, and forms of interaction may evolve over time, requiring periodic reconsideration of the proposed components.

Future research should examine the proposed curriculum model in different educational, cultural, and geographic contexts and compare whether the same components remain salient across diverse school systems. Further qualitative studies could include students, parents, school counselors, educational policymakers, and technology specialists in order to broaden the range of perspectives incorporated into curriculum design. Longitudinal research could investigate how students' ethical reasoning and digital behavior develop when cyber ethics is taught systematically over several school years. Design-based research could also be used to develop, implement, revise, and evaluate specific instructional units based on the proposed framework. Future investigations should additionally explore emerging ethical issues associated with artificial intelligence, algorithmic decision-making, deepfakes, generative technologies, biometric data, and increasingly personalized digital environments.

In practice, schools should treat cyber ethics as a coherent curricular responsibility rather than as an occasional topic addressed only after a digital problem occurs. Curriculum planners can use the identified components to design age-appropriate learning sequences that combine knowledge, discussion, scenario analysis, reflection, and practical decision-making. Teachers should receive professional preparation focused on facilitating ethical dialogue, managing sensitive topics, protecting student privacy, and providing feedback on reasoning rather than merely correcting answers. Educational materials should use realistic but anonymized scenarios, culturally appropriate examples, and clear performance criteria. Schools should also ensure that digital and physical learning environments support confidentiality, respectful participation, help-seeking, and psychological safety. Finally, assessment should be integrated with learning activities so that students are evaluated not only on what they know about cyber ethics, but also on how they analyze situations, justify decisions, interact with others, and apply ethical principles in realistic digital contexts.

Authors' Contributions

Authors equally contributed to this article.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

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