Business ethics and digital inquiry-based learning: exploring students' competence development

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Summary

Business ethics education is gaining increasing importance in times of global crisis, technological innovation, and social polarization. Questions of responsibility, fairness, and sustainability are economically relevant and essential for the functioning of democracy. As part of contemporary citizenship education, engaging with business ethics in schools contributes significantly to the development of students' moral judgment, value orientations, and reflective participation in society. Schools thus play a key role in promoting responsible judgment and action-oriented competences. However, this requires innovative pedagogical approaches that actively involve learners in addressing complex moral questions. Inquiry-based learning (IBL) is considered a particularly promising pedagogical approach in this respect, as it supports independent thinking, critical analysis, and reflective moral reasoning. The digital implementation of IBL further enhances its potential by promoting collaboration, offering adaptive support, and fostering the development of key digital competences. Despite the widely recognized potential of digital IBL, there is still a lack of systematic research linking business ethics education with digital IBL at the secondary level. To address this research gap, this dissertation examines how digitally supported IBL can contribute to the development of business ethical competences in secondary education and what factors influence its effectiveness by connecting the social scientific field of business ethics with a pedagogical approach originally developed in the natural sciences. The aim of this dissertation is to systematically analyze the key factors identified in the literature as influencing the effectiveness of digital learning—*learner* and *teacher characteristics*, *contextual conditions*, and *learning engagement*—across three empirical studies. By examining these elements, it investigates the effectiveness of digital IBL in the social sciences.

Focusing on *learner characteristics*, the first study, which employed a qualitative interview design, examined the conceptions of 33 eighth-grade students regarding business ethical issues.

The findings showed that students reflected on business ethics predominantly in a fragmented and individual-ethical manner. Although some students demonstrated various conceptions of ethical economic behavior, their reasoning largely remained limited to consumer decisions, while political dimensions were scarcely considered. This narrow perspective was further reflected in misconceptions about governmental and corporate responsibilities as well as the distribution of economic power in competitive markets.

The second study, which included 445 students, employed a quasi-experimental design to investigate the effectiveness of digitally supported IBL on competence development, considering *contextual* and *teacher-related influences*. While no evidence was found for a significant overall effect compared to traditional instruction, gender-specific differences emerged: for female students, digital IBL led to higher economic interest and intrinsic motivation, whereas male students showed a decrease in economic interest.

The third study examined the role of *student engagement*, which is widely recognized as a key success factor in digital learning environments. Based on log data from 285 students, the quantitative analysis revealed that higher levels of behavioral engagement were associated with greater knowledge gains and stronger development of business-related competences. Interactive and visually oriented learning formats proved particularly beneficial. Learners who exhibited balanced use of various activity types—termed “all-rounders”—achieved the best learning outcomes and displayed higher levels of digital competence.

Building on the findings of individual studies, this dissertation develops, for the first time, a subject-specific, empirically grounded framework model for the effectiveness of digital IBL in the social sciences. By illustrating and extending existing knowledge through the inclusion of *learner* and *teacher characteristics*, *contextual factors*, and *student engagement*, this work provides new empirical and theoretical insights into business ethics education at the secondary level and demonstrates how digital learning environments can be designed to foster critical reflection, sound moral judgment, and a sense of responsibility. Furthermore, the dissertation

offers conceptual implications for teacher education—for instance, in further developing adaptive, multiperspectival, and gender-sensitive approaches to instructional design—and educational policy, particularly concerning cross-curricular frameworks and infrastructural provisions. In doing so, it establishes an empirically substantiated foundation for future research and practice-oriented developments aimed at promoting innovative teaching and learning concepts that support democratic and ethically grounded citizenship education in the digital age.

Zusammenfassung

Wirtschaftsethische Bildung gewinnt in Zeiten globaler Krisen, technologischer Neuerungen und gesellschaftlicher Polarisierung zunehmend an Bedeutung. Fragen nach Verantwortung, Fairness und Nachhaltigkeit sind dabei nicht nur ökonomisch, sondern auch demokratisch relevant. Im Sinne einer zeitgemäßen politischen Bildung trägt die schulische Auseinandersetzung mit Wirtschaftsethik wesentlich zur Entwicklung von Urteilsfähigkeit, Werteorientierung und reflektierter gesellschaftlicher Teilhabe bei. Schulen übernehmen somit eine Schlüsselrolle bei der Förderung verantwortungsbewusster Urteils- und Handlungskompetenzen. Hierfür bedarf es jedoch innovativer Vermittlungsansätze, die Lernende aktiv in die Auseinandersetzung mit komplexen moralischen Fragestellungen einbeziehen. Das forschende Lernen gilt in diesem Zusammenhang als besonders geeignetes didaktisches Konzept, da es die Entwicklung eigenständiger Denkprozesse, kritischer Analysefähigkeit und reflektierter Urteilsbildung unterstützt. Die digitale Umsetzung forschenden Lernens erweitert dessen Potenzial zusätzlich, indem sie die Zusammenarbeit fördert, adaptive Unterstützung bietet und die Entwicklung zentraler digitaler Kompetenzen stärkt. Trotz der in zahlreichen Studien hervorgehobenen Potenziale des digital umgesetzten forschenden Lernens fehlt es bislang an einer systematischen Übersicht zur Verbindung von wirtschaftsethischer Bildung und digitalem forschendem Lernen in der Sekundarstufe. Um diese Forschungslücke zu schließen, untersucht die vorliegende Dissertation, wie digital unterstütztes forschendes Lernen zur Entwicklung wirtschaftsethischer Kompetenzen in der Sekundarstufe beitragen kann und welche Faktoren seine Wirksamkeit beeinflussen. Sie verbindet damit das sozialwissenschaftliche Feld der Wirtschaftsethik mit einem in den Naturwissenschaften entwickelten Unterrichtskonzept. Ziel der Dissertation ist es, in drei empirischen Studien die in der Literatur identifizierten relevanten Einflussfaktoren auf die Wirksamkeit digitalen Lernens – *Lernenden*- und *Lehrendenmerkmale*, den *Unterrichtskontext*

und das *Lernengagement* – systematisch zu analysieren. Auf dieser Grundlage soll die Effektivität digitalen forschenden Lernens im sozialwissenschaftlichen Unterricht untersucht werden.

Die qualitative Interviewstudie untersuchte vor dem Hintergrund von *Lernendenmerkmalen* die Vorstellungen von 33 Schüler:innen der achten Klasse zu wirtschaftsethischen Fragestellungen. Die Ergebnisse verdeutlichen, dass die Lernenden wirtschaftsethische Inhalte überwiegend fragmentiert und auf einer individual-ethischen Ebene reflektieren. Obwohl die Schüler:innen teilweise über vielfältige Konzepte wirtschaftsethischen Handelns verfügten, blieb ihre Argumentation überwiegend auf Konsumentscheidungen beschränkt, während politische Dimensionen kaum berücksichtigt wurden, was sich zugleich in Fehlvorstellungen über staatliche und unternehmerische Zuständigkeiten sowie über die Verteilung wirtschaftlicher Macht im Wettbewerb widerspiegelte.

Die zweite Studie untersuchte mithilfe eines quasi-experimentellen Designs mit 445 Schüler:innen die Wirksamkeit digital unterstützten forschenden Lernens auf die Kompetenzentwicklung unter Berücksichtigung *kontextueller* und *lehrkraftbezogener Einflussfaktoren*. Dabei konnte keine Evidenz für einen signifikanten Gesamteffekt im Vergleich zum traditionellen Unterricht nachgewiesen werden. Allerdings ergaben sich geschlechtsspezifische Unterschiede: Während das digital unterstützte forschende Lernen bei weiblichen Lernenden zu einer Steigerung des ökonomischen Interesses und der intrinsischen Motivation führte, war bei männlichen Lernenden ein Rückgang des ökonomischen Interesses zu beobachten.

Die dritte Studie untersuchte den Einfluss des *Lernengagements*, das als zentraler Erfolgsfaktor in digitalen Lernumgebungen gilt. Die quantitative Analyse auf Grundlage der Log-Daten von 285 Schüler:innen zeigte, dass ein höheres Maß an behavioralem Engagement mit größeren Wissenszuwächsen und einer stärkeren Entwicklung ökonomischer Kompetenzen verbunden war, wobei interaktive und visuell orientierte Lernformate besonders förderlich wirkten.

Lernende mit einer ausgewogenen Nutzung verschiedener Aktivitätstypen („All-Rounders“) erzielten zudem die besten Lernergebnisse und verfügten über ein höheres Maß an digitaler Kompetenz.

Auf Basis der Ergebnisse der einzelnen Studien entwickelt diese Dissertation erstmals ein fachspezifisches, empirisch fundiertes Rahmenmodell zur Wirksamkeit digitalen forschenden Lernens im sozialwissenschaftlichen Bereich. Durch die Veranschaulichung und Erweiterung bestehender Erkenntnisse um *Lernenden-* und *Lehrendenmerkmale*, *Kontextfaktoren* und *Schüler*:*innenengagement* liefert diese Arbeit neue empirische und theoretische Erkenntnisse zur wirtschaftsethischen Bildung in der Sekundarstufe und verdeutlicht, wie digitale Lernumgebungen gestaltet werden können, um kritische Reflexion, Urteilsfähigkeit und Verantwortungsbewusstsein zu fördern. Darüber hinaus bietet die Arbeit konzeptionelle Anknüpfungspunkte für die Lehrkräftebildung – etwa zur Weiterentwicklung adaptiver, multiperspektivischer und geschlechtersensibler Unterrichtsgestaltung – sowie für bildungspolitische Gestaltungsprozesse, insbesondere im Hinblick auf fächerübergreifende Curricula und infrastrukturelle Rahmenbedingungen. Damit legt sie eine empirisch fundierte Grundlage für zukünftige Forschung und praxisorientierte Entwicklungen, die auf die Förderung innovativer Lehr-Lern-Konzepte im Sinne einer demokratisch und ethisch fundierten politischen Bildung im digitalen Zeitalter abzielen.

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CE	Citizenship education
IBL	Inquiry-based learning
ECE	Economic citizenship education
BEE	Business ethics education
CSR	Corporate social responsibility
TEL	Technology-enhanced learning
MOOC	Massive open online courses

1. Introduction and theoretical framework

1.1 Relevance of business ethics and digital inquiry-based learning

"Ethics matters – but to think a step forward, ethics education matters"

Lau (2010, p. 582)

In an era of rapid economic and technological change, economic and political actors face increasing ethical responsibilities. From addressing biases in artificial intelligence systems (Chen et al., 2023) to reducing the environmental impacts associated with rising energy demands (Bosio & Schattle, 2023), organizations must navigate complex societal and ecological challenges (Montiel et al., 2020). This growing need for responsible decision-making underscores the importance of business ethics—described by De George (1999) as the interplay between ethics and business—in both corporate practice and academic discourse (Veledar & Bašić, 2021). This topic has repeatedly come to the forefront of public attention in the wake of numerous ethics scandals, such as the Wirecard case. Beyond corporate misconduct, persistent corruption underscores the importance of public institutions in shaping the conditions for ethical business environments. For example, in 2024, the average Corruption Perceptions Index stood at 43 points (0 = high corruption, 100 = very low corruption), a level that has remained virtually unchanged for over a decade, signaling persistent governance challenges and worldwide stagnation in anticorruption efforts. That more than two-thirds of the 180 assessed countries scored below 50 emphasizes the persistent and urgent need for action (Transparency International, 2025). Educational institutions bear a central responsibility in this regard, as moral reasoning begins to develop at a young age (Malone, 2020), and unethical behavior is already observable within school contexts (Alonso & Schweiger-Gallo, 2022). Within the educational sphere, business ethics is understood as an interdisciplinary endeavor that seeks to integrate economic, social, and ethical perspectives within a coherent

framework of reflection and learning (Ulrich, 2012). It therefore plays a central role in citizenship education (Piller, 2016).

Critical thinking and problem awareness are fundamental competencies for business ethics, as learners must be able to recognize ethical dilemmas, evaluate competing values, and develop well-reasoned positions. Inquiry-based learning (IBL) is particularly well suited for this purpose, as it encourages independent reflection, critical engagement, and the active exploration of controversial issues (Hermidayani et al., 2019; Iacovidou et al., 2020). Within this pedagogical model, learners investigate complex problems by formulating hypotheses, collecting and analyzing information, and developing well-reflected solutions based on their findings (Pedaste et al., 2015). Through this process, students strengthen ethical and metacognitive competencies (Nuraini et al., 2021), which are essential for responsible decision-making in economic and civic contexts.

Digital technologies can further enhance this potential by supporting the development of key 21st-century competencies (Nuraini et al., 2021), scientific literacy (Bónus et al., 2024), and digital skills (Gholam, 2019). In digital IBL, *student engagement* is considered a key determinant of effectiveness, influenced particularly by the *characteristics of students* and *teachers* as well as by the *context* (Al Mamun & Lawrie, 2023; Meyer, 2014; Miles et al., 2018). General instructional research indicates that these factors—together with *content*—collectively shape the overall effectiveness of all teaching approaches (Hirsh et al., 2022). Although research already exists on both business ethics education and digitally implemented IBL, studies on the former primarily focus on higher education, while research on the latter is mainly situated within the context of the natural sciences. Furthermore, the intersection between business ethics education and digital IBL has thus far received little empirical attention. This gap is particularly concerning because business ethics education should begin early to shape responsible decision-making, and IBL provides a pedagogical approach well

suited to fostering critical thinking and ethical reasoning in this domain. Accordingly, this dissertation aims to integrate business ethics with digitally supported IBL and examine its effectiveness. The analysis considers (1) *student-related characteristics*, (2) *teacher-related factors*, and (3) *contextual conditions*, as well as (4) *the content perspective*, which is situated within the discipline of business ethics. To achieve this objective, this work is guided by three central research questions:

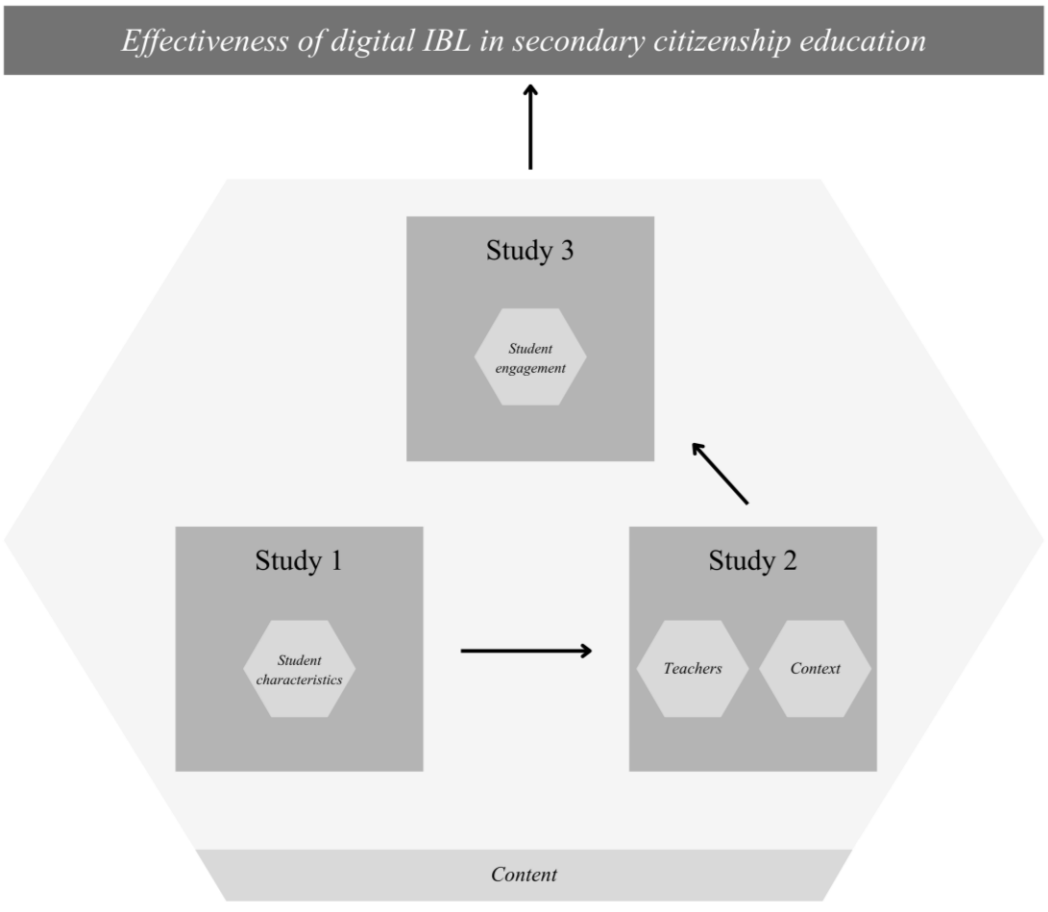
(1) *Which conceptions do students have regarding business ethical issues in the context of secondary education?*
(2) *To what extent does digitally supported inquiry-based learning foster the development of students' business ethical competencies?*
(3) *How do students' engagement patterns in digital learning environments differ, and how are these patterns related to the development of business ethical competencies?*

This dissertation consists of three manuscripts. The first manuscript presents a qualitative interview analysis of students' business ethical conceptions, aiming to capture their prior knowledge as an aspect of the influencing factor of *student characteristics*. Building on the findings of the first study, the second manuscript employs a quasi-experimental design to examine the effectiveness of digital IBL on students' business ethical competencies by comparing experimental and control groups. The collaboratively designed inquiry process, guided by both the teacher and the learning environment and supported by sufficient time resources and a curiosity-stimulating digital learning environment, enabled an integrated analysis of the influencing dimensions of *teacher characteristics* and *context*. The third manuscript focuses on *student engagement*, a key factor in the effectiveness of digital learning environments, and quantitatively investigates students' behavioral engagement as well as its relationship with the development of business ethical competencies. All three studies focus on secondary education since the early integration of business ethics into students' learning is of

particular importance (Babalola et al., 2023). Furthermore, business ethical topics are already anchored in the German school curriculum at this educational level (Ministerium für Kultus, Jugend und Sport Baden-Württemberg, 2016). Therefore, by analyzing the key factors influencing the effectiveness of digital IBL, this dissertation aims to generate insights into the optimal development of business ethical competencies at the secondary education level. The systematic classification of the studies and their coverage of relevant influencing factors are illustrated in Figure 1.

Figure 1

Overview of the studies



Note. Content forms the basis; student characteristics, teachers, context, and student engagement represent the key influencing factors; and student engagement emerges as the most central factor affecting the effectiveness of digital IBL.

By integrating the field of business ethics—stemming from the social sciences—with the pedagogical approach of digitally supported IBL, which is rooted in the natural sciences, this dissertation offers an innovative contribution that advances a novel perspective on the intersection of both disciplines. The following chapter situates business ethics within the broader framework of citizenship education and discusses its relevance and the existing empirical evidence regarding competence development. Subsequently, the concept of IBL is introduced as a suitable pedagogical approach, with a particular focus on its digital implementation, effectiveness, and key determinants. The significance of the three studies included in this dissertation is then outlined before they are presented in detail in separate chapters. In the final chapter, the findings of the three studies are synthesized, limitations are discussed, and both theoretical and practical implications are derived, leading to the overall conclusion of the dissertation.

1.2 Business ethics in citizenship education

1.2.1 The concept of citizenship education

Political education, *civic education*, or *citizenship education*? As a "contested field" (Carretero et al., 2015, p. 295), both the objectives of this discipline and its very designation are subject to debate (Muleya, 2018). For this dissertation, clarifying these concepts is essential, since citizenship education provides an important normative and pedagogical foundation for teaching business ethics, particularly when fostering responsible participation in economic and societal life. The following section briefly outlines and situates these terms.

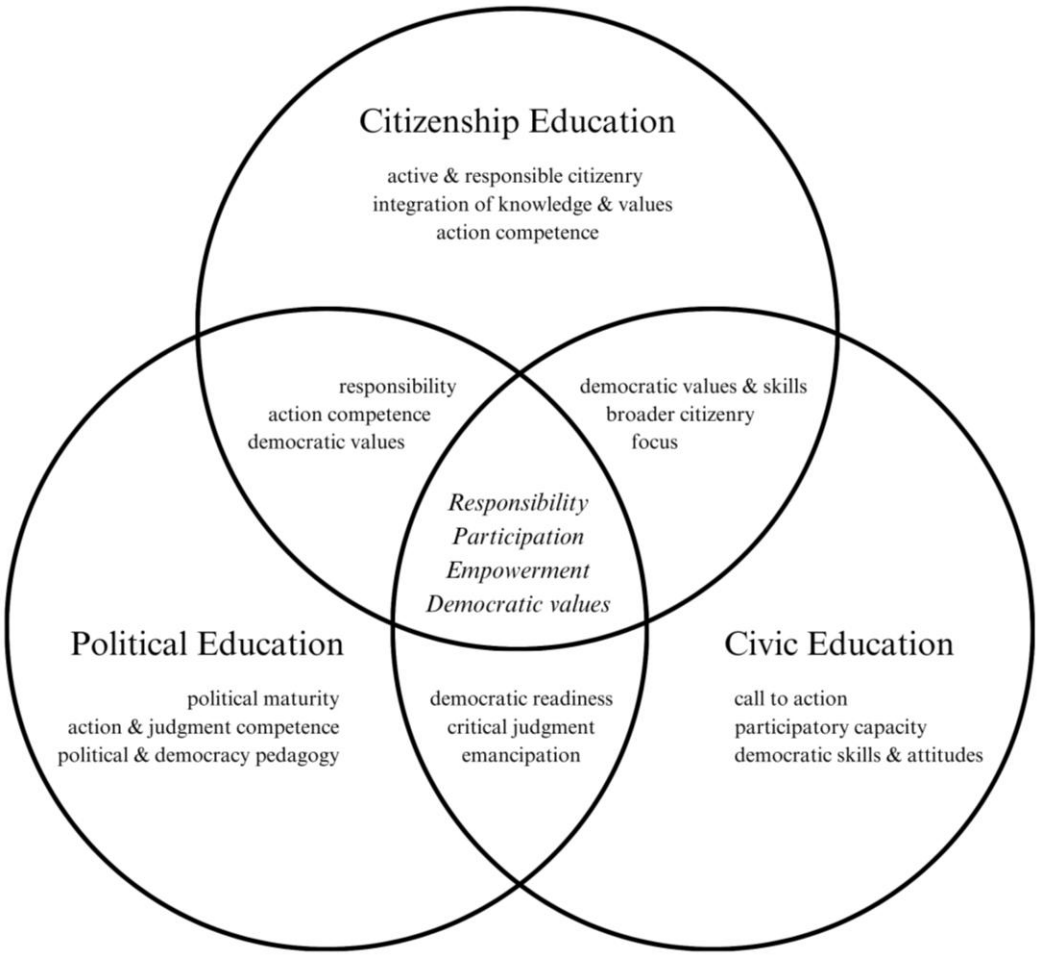
In the German context, the term *political education* is frequently used. It encompasses, on the one hand, the promotion of the ability to critically assess political interrelations and, on the other hand, the strengthening of action-oriented competence to assert one's own interests and convictions within political processes (Bremer & Gerdes, 2022). Its overarching aim is

"political maturity" (Kenner, 2020, p. 132). In the school context, alongside political pedagogy as a conceptual orientation of political education, so-called "democracy pedagogy" (Kenner, 2020, p. 120) has emerged in Germany as an additional approach (Bremer & Gerdes, 2022). Within this framework, two distinct yet not mutually exclusive functions of political education become visible: first, the contribution to the stabilization and legitimation of the political system, and second, the emancipation of the subject vis-à-vis existing structures of power and domination (Kenner, 2020). When transferred to English-speaking discourse, these debates are frequently situated under the label *civic education*, a broad and contested term that captures diverse traditions and normative orientations (Carretero et al., 2015). Nevertheless, substantive commonalities can be identified. Civic education is predominantly understood "as representing something of a call to action" (Muleya, 2018, p. 115), fostering democratic skills, values, and attitudes while extending beyond the school setting. The term is often used synonymously with *citizenship education*, as both pursue an educational policy agenda. However, depending on the context, the two concepts target different objectives (Muleya, 2018). Indeed, within citizenship education itself, a variety of approaches can be identified, such as multicultural citizenship (Banks, 2001), citizenship as a set of critical practices (Abu El-Haj, 2009), and democratic citizenship (Nussbaum, 2006). In general, compared to civic education, citizenship education can be understood as education for an active, responsible, and value-oriented citizenry that integrates knowledge, values, and action-oriented competences (Muleya, 2018). While civic education places a stronger emphasis on promoting democratic readiness to act and participatory capacity, citizenship education focuses more on the comprehensive development of a responsible, values-driven, and competent citizenry. In the German context, citizenship education can be regarded as an overarching connecting element between the approaches of political pedagogy and democracy pedagogy. Against this backdrop, citizenship education is defined as "an integrative process of education to maturity […] which emanates from the

subject and is based on basic democratic values such as freedom, equality, justice, and solidarity" (Kenner, 2020, p. 119). To enhance clarity regarding the three approaches and their respective objectives, Figure 2 provides a comparative overview.

Figure 2

Conceptual overlaps and distinctions between political education, civic education, and citizenship education



In the following, the term *citizenship education* (CE) is employed as it provides an integrative conceptual framework; it encompasses the German discourse on political and democracy pedagogy while at the same time aligning with the international debate. Compared to civic education, it more explicitly emphasizes the development of a responsible, value-oriented, and competent citizenry. In this work, citizenship education is understood in line with Kenner

(2020) as an integrative process of education to maturity grounded in core democratic values—that is, as a holistic approach to promoting responsible democratic agency.

1.2.2 Importance of socioeconomics in citizenship education

"Perhaps no other social studies discipline has incited a sense of urgency or importance in the public discourse quite like economics" (Adams, 2019, p. 16). Recently, the 2024 change in U.S. political leadership, followed by notable adjustments in trade and tax policy as well as increased societal polarization, illustrates the substantial influence of political decision-making on economic dynamics and the close interdependence of both spheres. There is broad consensus that the economy constitutes a central field of political action (Haarmann, 2020; Hedtke, 2019; Moegling, 2012), as it is shaped by goal and interest conflicts, reflects power structures, and exerts influence on political domains (Haarmann, 2020). Global challenges such as pandemics, climate change, migration, and authoritarian developments illustrate the complex and often contradictory interrelations between economy, society, and politics (Fridrich et al., 2024). The scholarly nexus between politics and economics is located within the field of political economy, which seeks to analyze and assess the interactions of the state, society, and economy from both an economic and political perspective (Moegling, 2012). Given its everyday practical relevance—for example, in decisions about consumption or planning for retirement—political economy must necessarily be addressed within school education (Bieling & Salomon, 2022). Moreover, understanding these interrelations is a matter of knowledge and ethical judgment; decisions in economic and political spheres often involve conflicts of interest, questions of fairness, and responsibility toward society and the environment. This ethical dimension connects political economy to business ethics education, which aims to prepare learners for responsible decision-making in complex socioeconomic contexts.

"Due to the sociopolitical salience of financial decisions there is systematic interaction of financial and citizenship education" (Remmele & Seeber, 2012, p. 189). Against this background, a solid economic education is indispensable for critically examining political discourses on economic issues (Adams, 2019; Remmele & Seeber, 2012). For instance, Amagir et al. (2018) emphasized that young people must be "financially empowered and capable" (p. 57) to realize their full potential as citizens. Consequently, the conveyance of socioeconomic interrelations constitutes a core component of CE[1] (Engartner et al., 2021; Hedtke, 2019). Therefore, in the context of politics instruction, it is not meaningful to regard economics as an autonomous domain of knowledge taught according to its own rules and standards in isolation from CE (Moegling, 2012). Given the multiplicity of policy areas, CE addresses economic matters precisely when economic problems become the subject of political action (Piller, 2016). It is thus hardly surprising that economics has long been a central area of learning in CE and its predecessors in Germany and that it is firmly embedded in the competence frameworks of politics instruction (Detjen et al., 2004; Grammes, 2006). In an international comparison, the relevance of economic education within CE becomes apparent. For example, in England, the national curriculum for CE requires that all 14- to 16-year-olds be taught "income and expenditure, credit and debt, insurance, savings and pensions, financial products and services, and how public money is raised and spent" (Department for Education and Employment, 2013, p. 3).

In CE, the acquisition of knowledge is fostered, among other means, through engagement with controversies to develop an understanding of fundamental disciplinary concepts (e.g., Weißeno et al., 2010). It emphasizes the importance of (social scientific) analytical competencies as well as the capacity for critical self-reflection on one's own judgment (Reinhardt, 2015), which is

[1] *Economic citizenship education* (ECE) is deliberately not addressed here, as it represents an approach to financial education in the sense of economic citizenship and is based on the three pillars of *social education*, f*inancial education*, and *livelihoods education* (Penner & Sanderse, 2017). However, unlike citizenship education, it does not focus on political issues and is therefore not directly relevant to the present work.

why politics instruction is, by necessity, of a critical nature (Kenner & Lange, 2019). In a democratic society, decision-making processes, along with the functions of political actors and institutions, are subject to continuous renegotiation and critical scrutiny.

Within the German context, three competencies have thus emerged as fundamental to CE: *(1) analytical competence*, *(2) judgment competence*, and *(3) action-oriented competence* (Kenner, 2020). According to Piller (2016), economic competence models similarly emphasize the primacy of developing judgment- and action-oriented competencies as essential for meeting the demands of everyday life, and in CE, they can serve as a bridge between everyday experiences and political contexts. A key element of judgment and action-oriented competence in the domains of society, economy, and politics is plurality—or multiperspectivity—as a central pillar for understanding the interrelations between economy, politics, and society, as well as the role of science (Hedtke, 2015). At the core of both citizenship and economic education lies the ideal of the autonomous, responsible citizen, and a distinction between the economically literate citizen and the politically literate citizen as normative models is not necessarily required (Moegling, 2012; Wangler, 2019).

To ensure that controversial topics can be discussed openly and fairly in the classroom, CE in Germany is based on the Beutelsbach Consensus, which emerged from a conference on CE in 1976 and is founded on three core principles (Wehling, 1977, pp. 179–180): *(1) the prohibition of overwhelming/indoctrination*: given the openness and contestability of democratic processes of knowledge and learning, the indoctrination of opinions is impermissible; *(2) the principle of controversy*: issues that are contested in science and politics must be presented as controversial in the classroom; and *(3) the principle of learner orientation*: students should be enabled to recognize themselves and others as political subjects with distinct and thus divergent interests. Regarding these principles, the relevance of addressing economic dimensions becomes evident. For example, when dealing with economic topics, any form of indoctrination must be avoided

in the interest of supporting maturity and multiperspectivity. This is of particular importance when integrating economic issues into CE and the associated learning processes, which treat economic relations as integral components of social structures. In accordance with the principle of controversy, it is also essential for CE to acquire, critically engage with, and understand economic knowledge. In this context, *homo oeconomicus*—which represents rational, utility-maximizing behavior in economics—serves as an illustrative example. When introduced in CE, it opens opportunities to establish connections both to value-related perspectives and to categories of citizenship pedagogies while also integrating moral judgment (Piller, 2016). *Homo oeconomicus* can thus help prevent unreflective moral reasoning (Suchanek, 2007) and offer a contrasting lens on individual behavior.

1.2.3 Relevance of business ethics in citizenship education

CE "is certainly a kind of moral education" (Bull, 2006, p. 16) and "provides students with the tools to consider the broader societal implications of business decisions" (Van Matre et al., 2025, p. 5). Against this background, the term *ethical global citizenship education* is used to illustrate the relevance of developing ethical awareness within the context of global economic and citizenship education. Its aim is to foster ethical responsibility and values to enable learners to evaluate principles often associated with market-oriented forms of globalization, such as deregulation, privatization, and free trade (Bosio & Schattle, 2023).

CE in the German context also places a strong emphasis on values and ethical reflection (Deichmann, 2004). On the one hand, the analysis of political content and objectives (policy), institutional structures (polity), and political actions and processes (politics) can be directed toward economic issues, institutions, and forms of action, which are to be examined from an ethical perspective. On the other hand, this includes ethical awareness and interpretation of actions and situations, ethical reflection on underlying assumptions and attitudes, and ethical

analysis of societal conditions—each with regard to economic references within political processes (Piller, 2015).

The objective of addressing economic aspects within the context of CE is to enable learners to evaluate social and economic issues from a politico-economic perspective in a reflective and ethically informed way (Dubs, 2001). In the educational context, business ethics is conceived as an interdisciplinary task that seeks to integrate considerations of economy, society, and ethics. With its enlightening character, it contributes to the formation of autonomous and responsible subjects (Ulrich, 2012).

For example, against the backdrop of political judgment and action-oriented competence, working with moral dilemmas provides a valuable approach. Such dilemmas aim to render students' moral knowledge explicit and differentiated, thereby enabling a greater sense of orientation and security (Schmidt, 2015). Within the context of CE, it is therefore essential to analyze and critically assess the different decision-making fields of specific life situations in light of morally responsible action. The initial focus lies on comprehending and managing such a process of reflection before proceeding to more in-depth engagement with the diverse problem areas explored in the field of business ethics (e.g., consumer behavior, corporate responsibility, environmental and sustainability issues, or globalization) (Piller, 2015). In this regard, the various concepts of business ethics address different problem areas and offer distinct perspectives for their examination.

1.2.4 Key concepts of business ethics

Building on the close interrelation of politics and economics in CE, business ethics addresses the ethical dimensions of economic action in light of global challenges such as climate change and social inequalities (Montiel et al., 2020). Business ethics connects two main disciplines—philosophy and economics—and is perceived differently in various regions and countries. The conception of business ethics that emerged in Germany, especially from the 1980s onwards,

differs fundamentally from the widely established U.S.-influenced conception (Aßländer, 2022; Lütge & Uhl, 2021).

With a pragmatically oriented theoretical framework, U.S. business ethics is characterized by a strong focus on application and individual ethical considerations and less emphasis on justifying norms (Palazzo & Palazzo, 2011). While U.S. business ethics is strongly focused on corporate ethics, business ethics in the German-speaking region primarily examines the economy and society as systemic issues and places greater emphasis on theoretical foundations (van Liedekerke & Demuijnck, 2012). Specifically within the German research context, a clear distinction can be made between business ethics and corporate ethics, as the question of the "loci of morality" (Schank & Hirata, 2024, p. 285) constitutes a central and recurring subject of discourse in German-language business ethics. The identification of such loci is often carried out by means of a micro-, meso-, and macro-level model that brings individuals, collective actors, and institutions alike into focus as potential loci of morality (Schank & Hirata, 2024). Business ethics is treated at the macro level and deals with questions of a just economic order at the national or international level, whereas corporate ethics, from the perspective of the company, addresses issues related to the relationship between companies and employees as well as companies and the environment. Additionally, the German debate is characterized by questions of justification in business and corporate ethics (Aßländer, 2022; Lütge & Uhl, 2021). In the U.S. context, the debate on business ethics essentially centers on two dimensions: first, the individual-ethical perspective concerning leadership and employees, and second, organizational questions of responsibility, primarily negotiated within the framework of *corporate social responsibility* (CSR). Both approaches tend to view the individual not in their entirety but rather in their specific role as a function bearer, with the central concern being how to ensure norm-conforming behavior—predominantly in the interest of the company (Schank & Lorch, 2019). CSR, in particular, has gained increasing significance (Lütge & Uhl, 2021).

However, the concept has become increasingly blurred, now encompassing corporate responsibility as well as approaches such as *corporate citizenship* (Moon et al., 2005), *stakeholder theory* (Freeman et al., 2010), and principles of good corporate governance (Gilbert et al., 2011). Overall, the Anglo-American debate on business ethics has been criticized for being comparatively weak in its theoretical grounding (Münch, 2015). In the literature, this debate further reflects a thematic shift from a primary focus on ethics toward a stronger emphasis on sustainability (Jaganjac et al., 2024).

In the German context, the literature commonly identifies four central approaches: the discourse ethical concepts of *integrative economic ethics* developed by Peter Ulrich (1997) and the *republican approach* of Horst Steinmann and Albert Löhr (1992), Karl Homann's *order-ethics approach* (Homann & Blome-Drees, 1992), and *governance ethics*, introduced by Josef Wieland (1999). In this context, the approaches of Ulrich and Homann can be assigned to business ethics, whereas those of Steinmann and Löhr, as well as Wieland, can be attributed to corporate ethics (Aßländer, 2022). Since this work aims to consider business ethics both from the perspective of companies and through a structural analysis of the economic order, the discussion therefore focuses on the German context—specifically on the two approaches of Ulrich and Homann.

Ulrich argues that the core question of business ethics is "economic rationality, as forced on us by the inherent logic of the market, to be firmly linked with ethical reason, by which we mean the normative logic of the reciprocal relationship between free human beings" (Ulrich, 2008, p. 2). In contrast, Homann's approach focuses on the question of which moral norms and ideals can be asserted by economic actors under the conditions of a modern economy and society (Homann & Blome-Drees, 1992). While Ulrich's approach seeks to fundamentally reshape economic processes through ethical principles, Homann instead emphasizes the necessity of deriving ethical norms from the functional logics of the economy itself (Loerwald, 2010).

Homann's order ethics has, however, been criticized for placing ethics at risk of becoming dependent on, or absorbed by, economic rationality (Heidenreich, 2012). Conversely, Ulrich's integrative economic ethics has been viewed as tending to overlook economic constraints and institutional realities, which may limit its applicability in real-world contexts. A more detailed discussion of the theoretical foundations and specific features of the approaches is provided in Chapter 3, which is why only a brief overview is given here. While the theoretical foundations provide the conceptual framework, it is equally important to consider empirical findings on students' conceptions and competencies regarding business ethics.

1.2.5 Empirical evidence on students' business ethical conceptions and competence development

Moral reasoning develops between the ages of six and nine—independently of cognitive development (Beißert & Hasselhorn, 2016; Malone, 2020)—and secondary education plays a formative role both in shaping personality traits and in transmitting fundamental value orientations (Kohlberg, 1975; Safder & Hussain, 2018). Introducing business ethics at this stage, therefore, substantially contributes to the formation of a stable moral compass and prepares students for future ethical challenges (Alonso & Schweiger-Gallo, 2022; Babalola et al., 2023). Nevertheless, the emerging research field of *business ethics education* (BEE) has thus far concentrated primarily on higher education (Martini et al., 2025). As a result, numerous empirical studies have analyzed the impact of ethics courses on knowledge and practice in the university context (e.g., Medeiros et al., 2017; Okechukwu Ugwuozor & Otu, 2020; Parks-Leduc et al., 2021). These studies consistently indicate that ethics education is significantly associated with improvements in ethical decision-making ($\beta = .15$; $p = .02$) and heightened ethical awareness ($F(1,717) = 141.37$; $p < .001$; $\eta^2_p = .94$) (Okechukwu Ugwuozor & Otu, 2020; Parks-Leduc et al., 2021).

In the context of secondary education, only a limited number of empirical studies in the field of business ethics are available (Alonso & Schweiger-Gallo, 2025). With regard to economic and ecological conceptions, students demonstrate a wide range of understandings, ranging from basic notions such as production costs to more sophisticated reflections on resource use and its consequences (Ignell et al., 2017). Moreover, there is evidence of a general awareness of ecological challenges (Mahat et al., 2022; Nováková et al., 2018), although this understanding is often acquired outside formal school contexts (Nováková et al., 2018). In contrast, findings in the domain of social and global justice reveal notable gaps: Students frequently overlook power relations and mechanisms of exploitation (Kleinschmidt et al., 2015) and display unreflective perspectives on the social market economy (Kaiser et al., 2015). Furthermore, students exhibit inconsistencies in their conceptions of impartiality as well as in their broader normative orientations (Ekström & Lundholm, 2021).

In terms of ethical–moral competence development, evidence indicates that higher levels of ethical competence are associated with more tolerant and empathetic attitudes (Nikolova, 2016). While the majority of students in one study were found to possess the necessary foundations of ethical knowledge in secondary education, approximately one-third exhibited substantial gaps (Ivanov, 2016).

Despite these insights, a notable gap remains in the empirical research on business ethics education at the secondary level. To date, no study has specifically addressed the development of business ethics competences in this context. Against this backdrop, the present work focuses on the promotion of business ethics in secondary education. Business ethics competences are considered to benefit especially from IBL approaches (Nuraini et al., 2021). Since IBL actively promotes critical thinking and problem orientation (Hermidayani et al., 2019; Iacovidou et al., 2020), it appears especially well suited for conveying economic–ethical content (Nuraini et al., 2021).

1.3 Inquiry-based learning in secondary education

"Tell me and I forget, show me and I remember, involve me and I understand" (attributed to Franklin, n.d.). The IBL approach encourages active participation in the learning process (Wariyanti, 2019) and has demonstrated positive effects across numerous empirical studies (e.g., Inel-Ekici & Ekici, 2022; Prayogi et al., 2022; Zafra-Gómez et al., 2015). However, these studies primarily focused on higher education, whereas comparatively few works have addressed younger learners (Dooly & Darvin, 2022). One reason for this gap is the longstanding assumption that children possess only limited capacities to perceive and understand their social context (Kelly & Brooks, 2009). Yet, research shows that children already enter school with preexisting social beliefs and biases (Ramsey, 2008). Consequently, scholars have argued for the development of early educational approaches that build on these prior conceptions and promote critical engagement with social stereotypes through interactive and reflective learning processes (MacDonald, 2019).

1.3.1 Inquiry-based learning as a pedagogical approach

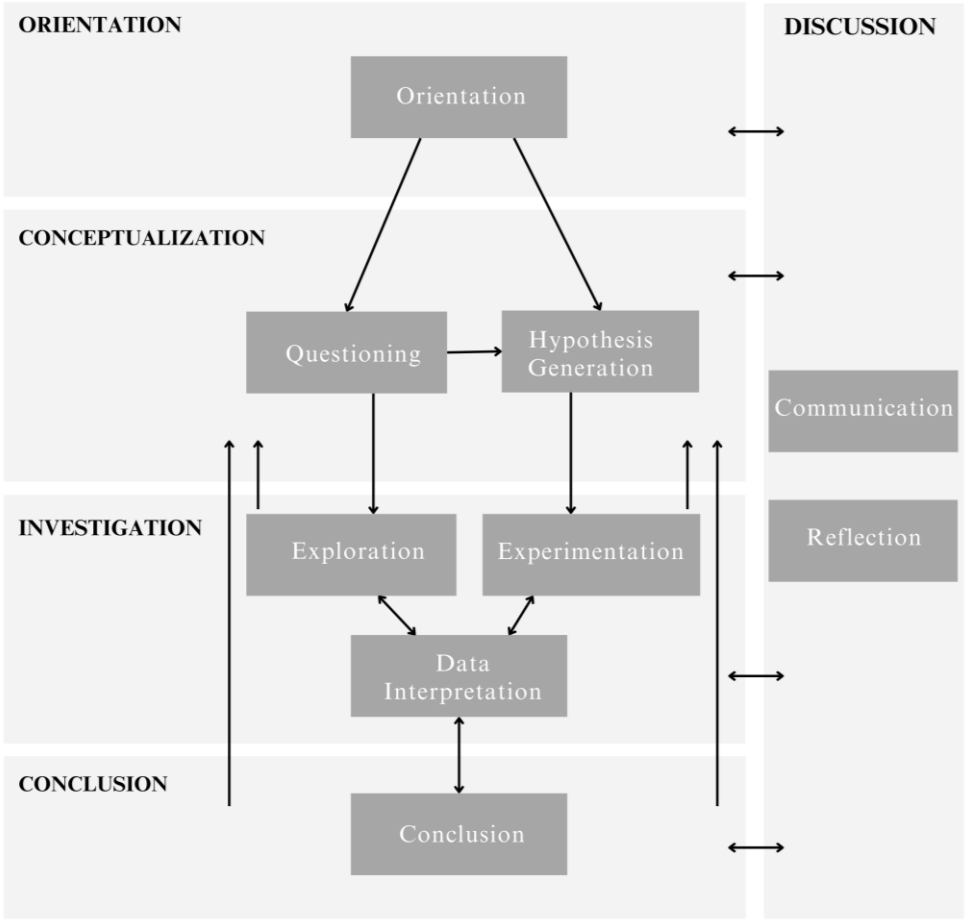
IBL was highlighted long ago by both the U.S. National Research Council (2000) and the European Commission (2007) as a key component in developing a scientifically literate society. It is understood as an instructional approach that places learners at the center of the educational process and enables them to actively shape their learning through independent questioning, investigation, and answering (Caswell & LaBrie, 2017). However, a closer examination of IBL raises the question of how it should be distinguished from similar approaches, such as research-based learning or research-oriented learning. Both research-based learning and IBL emphasize the active involvement of students in the process of knowledge acquisition (Nuraini et al., 2021; Syahid et al., 2023; Wariyanti, 2019). Research-based learning, however, aims to promote students' ability to independently establish connections between research content and their own learning (Nuraini et al., 2021), whereas IBL is directed

toward collaborative problem-solving, during which students acquire research skills and develop the capacity for reasoned judgment (Avsec et al., 2014; Syahid et al., 2023). Research-oriented learning, in contrast, focuses primarily on the acquisition of research methods and techniques (Nuraini et al., 2021); therefore, IBL can be seen as an overarching concept that integrates elements of both approaches. IBL can thus be characterized as a form of self-directed learning in which learners assume central responsibility for their learning (Spronken-Smith & Walker, 2010). Defined as a process, IBL emphasizes the discovery of new causal interrelations, which are developed through the formulation of hypotheses, and their subsequent testing by means of observation or experimentation (Liu et al., 2021; Pedaste et al., 2015; Van Der Graaf et al., 2020). Overall, IBL promotes the development of an understanding of interrelations and "fosters the ability to recognise the general in the specific" (Pasternack, 2019, p. 23).

In detail, IBL can be divided into individual components called "inquiry phases" (Pedaste et al., 2015, p. 48), which together form the inquiry cycle (see Figure 3). Based on a variety of inquiry phases, Pedaste et al. (2015) developed a widely acknowledged framework (see, e.g., Prihatin et al., 2024) with five general inquiry phases for IBL: *orientation*, *conceptualization*, *investigation*, *conclusion*, and *discussion*.

Figure 3

Inquiry-based learning framework



Note. Adapted from Pedaste et al. (2015, p. 56).

Orientation, as the phase of introducing the learning topic, aims to stimulate interest in the presented problem (Scanlon et al., 2011). The result of this phase is a research problem. *Conceptualization* is divided into the two subphases of questioning and hypothesis generation and can be described as a process of understanding concepts in the context of the problem (Jami & Muharam, 2022). The outcome of conceptualization is one or more research questions and/or hypotheses. The *investigation* phase responds to the research questions or hypotheses by translating the interest sparked in the orientation phase into action and consists of the specific subphases of exploration, experimentation, and data interpretation. Exploration generally refers to conducting an investigation with the aim of finding interrelations among variables.

Experimentation, as a result of hypothesis generation, focuses on creating and applying a strategic plan for the experiment with a specific timeline. Both phases involve data collection (Pedaste et al., 2015). In contrast, data interpretation aims to generate new knowledge from the collected data (Bruce & Casey, 2012). The outcome of this phase is the interpretation of the data, allowing conclusions to be drawn regarding the research questions and hypotheses. The *conclusion* phase connects the results of the data interpretation with the research questions and hypotheses, leading to the generation of new theoretical insights. The result is a conclusion about the findings in the context of the research questions and hypotheses (Pedaste et al., 2015). With the two subphases of communication and reflection, the *discussion* can take place at both the level of individual phases within the cycle and in relation to the entire inquiry process. Communication primarily refers to the presentation of results and conclusions to peers, while reflection can be understood as an internal process of contemplation (Scanlon et al., 2011).

A review of previous research reveals that various studies provide evidence of the positive effects of implementing IBL (e.g., Lameras et al., 2021; Mutlu, 2020). For example, studies have shown that students who engage in inquiry-based approaches develop a deeper understanding of subject matter (Kersting et al., 2023; Strat et al., 2024), achieve higher academic performance (Bruder & Prescott, 2013), enhance their critical thinking skills (Rahmi et al., 2019), and exhibit increased learning engagement (Meitriana et al., 2021). However, previous research in this field has primarily focused on science education (e.g., Furtak et al., 2012; Lazonder & Harmsen, 2016). In light of the growing importance of problem orientation and cyclical thinking, particularly in social science subjects such as economics, the IBL approach is increasingly moving into the focus of social science education (Iacovidou et al., 2020; Levy et al., 2010).

1.3.2 Implementation of digital inquiry-based learning in socioeconomic education

Critical thinking, problem-solving, and information analysis are only three of the many skills promoted by IBL and simultaneously hold a central position in socioeconomic education (Marks, 2013). This learning approach is particularly well suited for social science education for several reasons. Similar to CE, IBL is *problem oriented* in its design (Leite, 2022). Moreover, IBL emphasizes the development of *individual maturity* (Egtved, 2023), which is likewise a core objective of CE. In addition, its scientific orientation fosters *critical thinking*, thereby strengthening students' political judgment (Juchler, 2021). In line with the goal of CE to educate students as responsible and democratically capable citizens, the ability to continuously ask questions and engage in critical reflection is of central importance (Leite, 2022). Within citizenship and economic education, this further entails the promotion of critical trust in democratic problem-solving processes. Such trust is not cultivated through teacher-centered instruction but rather through the examination of political problems, engagement with controversy, and deliberate avoidance of indoctrination (Egtved, 2023). For a critical, research-oriented pedagogy, economic and political issues are particularly well suited, as they promote active and responsible citizenship (Anugrah et al., 2025; Hernández-Serrano, 2021). Moreover, IBL empowers students to make *independent and informed decisions*—an important goal of CE that is gaining increasing significance in today's digitally connected world (Dooly & Darvin, 2022; OECD, 2021).

Within the context of IBL, the use of new technologies is attributed to enhancing effectiveness (e.g., De Jong et al., 2014; Hofhues, 2019), as they provide access to an almost unlimited amount of digitally processed and immediately available information. In this regard, the smart learning–based inquiry strategy was developed as an extension to classical inquiry approaches, aiming to deliberately deepen conceptual understanding and problem-solving competence through the use of digital technologies (Yasa et al., 2024), since "[a]t all stages of the

(empirical) research process, digital media […] serve the purpose of helping to achieve learning objectives" (Hofhues, 2019, p. 376). This is also reflected in a range of empirical studies demonstrating that technology-supported IBL enhances a variety of scientific competencies, including problem identification, the formulation of questions and hypotheses, and data collection and analysis (e.g., Bónus et al., 2024; De Jong et al., 2014; Hofhues, 2019). Furthermore, learners can further develop their digital competencies through the use of digital technologies (Gholam, 2019). Peters and Stout (2011), for example, proposed embedding e-learning as a cross-cutting component within their inquiry cycle for science education. In this regard, technology-enhanced learning (TEL) is generally understood as the use of digital tools that support learning processes—for instance, through the provision of digital resources or the facilitation of communication (Hillen & Landis, 2014). Many concepts of IBL are closely associated with the simultaneous use of digital media, leading to an increasing conceptual overlap between IBL and TEL (Hofhues, 2019). In social science education specifically, the combination of inquiry and TEL appears particularly promising, as it substantially contributes to the development of 21st-century competencies (Nuraini et al., 2021). In this context, "digital media offer the opportunity to create diverse learning environments that open up an interactive and multi-perspective exchange about political and social problems" (Kenner, 2020, pp. 131–132). Building on this, IBL emerges as a particularly effective instructional practice at the secondary level, as it deliberately prepares students for active participation in civic life (Dwomoh, 2025).

1.3.3 Effectiveness of digital inquiry-based learning on competence development

If "technology enhances inquiry, and inquiry reinforces effective citizenship education" (Dwomoh, 2025, p. 51), the question arises as to which specific competencies[2] are fostered or

[2] Competencies are broadly defined in this context as "a set of observable and measurable 'attributes' or 'success factors' required for individuals for effective work performance" (Wong, 2020, p. 100). These attributes typically

further developed. Existing research on the effectiveness of digitally implemented IBL indicates positive effects across various competencies:

(1) Critical thinking. A quasi-experimental study investigated the effectiveness of the smart learning–based inquiry method in enhancing critical thinking in natural science education (Yasa et al., 2024). Using a pre–post test control group design, the results showed significant improvements in critical thinking (ES = 1.50) among sixth graders ($N = 110$) compared with traditional IBL. In the social sciences, evidence is limited to the use of traditional (nondigital) IBL. For instance, a quasi-experimental study analyzed the critical thinking skills of fifth-grade students ($N = 80$) in civic education (Kaçar & Çakmak, 2020). The results indicated a significant improvement in critical thinking ($t_{78} = 4.12$, $p < .05$). Similar findings have been reported in economics education. A quasi-experimental study demonstrated that the critical thinking skills of 11th graders ($N = 36$) were more effectively enhanced through IBL than through traditional teaching methods (Astina et al., 2025). In line with these findings, Azmi and Kurniawan (2025) conducted an intervention study—without a control group—using questionnaires and observation sheets. Their results indicated significant improvements in critical thinking ($p < .001$) among 32 senior high school students through the application of IBL. In the context of education for sustainable development, a quasi-experimental study of 10th graders ($N = 71$) demonstrated significant gains in critical thinking in the experimental group compared with the control group (Setiyaningsih et al., 2024).

(2) Scientific process skills. In the natural sciences, numerous studies have demonstrated the positive effects of technology-supported IBL on scientific process and inquiry skills

include knowledge, skills, self-concept and values, personal traits, and motives (Campion et al., 2011; Spencer & Spencer, 1993).

(e.g., Bónus et al., 2024; Koyunlu Ünlü & Dökme, 2020; Lin et al., 2012). For instance, in biology classes for grade 8 students ($N = 257$), a quasi-experimental study reported a small to medium effect (Cohen's $d = 0.46$) on students' inquiry skills through the implementation of IBL combined with game-based learning (Bónus et al., 2024). To the best of my knowledge, there is no empirical evidence regarding the effects of IBL on the development of inquiry skills in the social sciences, either in traditional or digital formats.

(3) Problem-solving. Similar to scientific process skills, evidence on problem-solving is limited to the natural sciences. An experimental study that combined game-based learning and digital IBL demonstrated significant improvements in students' perceived problem-solving abilities ($F = 5.55$, $p < .05$, $\eta^2 = 0.054$) among sixth graders ($N = 101$) (Hwang & Chen, 2017). Other studies have confirmed the positive effects of traditional IBL in STEM contexts (e.g., Beswick, 2021; Maxwell et al., 2015). Within the social sciences, empirical validation is still absent.

(4) Academic achievement. A meta-analysis of 36 studies found a significant positive effect (ES = 0.91) of integrating IBL with mobile devices on academic achievement in the sciences (Zheng et al., 2018). Furthermore, an intervention study in the social sciences examined the impact of a mobile inquiry-oriented learning model on learning outcomes (Hwang et al., 2013). The results revealed significant positive effects on the performance of the experimental group compared to the control group ($F = 4.36$, $p < .05$) among sixth graders ($N = 56$).

(5) Engagement and motivation. Empirical evidence demonstrates the significant positive effects of digitally implemented IBL approaches on motivation and engagement, both in higher education foreign language learning (Chang et al., 2016) and in secondary-level science instruction (Meng & Jumaat, 2024; Vogel et al., 2010).

In the social sciences, however, evidence is limited to traditional IBL. For example, a study in economics education examined learner activity across two cycles of IBL implementation using observation protocols (Meitriana et al., 2021). The findings revealed increased learner activity among 11th graders (N = 29); however, no control group was included.

(6) Conceptual understanding. In physics education, a study employing a quasi-experimental, pre–post test, control group design investigated the effectiveness of inquiry models combined with a virtual laboratory (Hermansyah et al., 2019). The results indicated significant improvements in conceptual understanding among secondary school students (N = 58) in the experimental group compared to the control group. To the best of my knowledge, no comparable evidence exists in the social sciences to date.

(7) Digital literacy. Within the smart learning–based inquiry framework, the effectiveness of digital IBL in fostering digital literacy has been analyzed in science education (Yasa et al., 2024). A quasi-experimental study with 110 sixth graders revealed significant improvements in digital literacy (ES = 2.548) compared to traditional inquiry methods. To the best of my knowledge, there is currently no empirical evidence on the effects of IBL on the development of digital literacy in the social sciences.

The empirical evidence base indicates considerable potential for digitally implemented inquiry-based approaches. Table 1 provides an overview.

Table 1

Overview of the evidence on digital IBL by discipline and competence

	Evidence in STEM disciplines	**Evidence in the social sciences**	
	Digital IBL	Digital IBL	Non-digital IBL
Critical thinking	Grade 6, $N = 110$, quasi-experimental; ES = 1.50 (Yasa et al., 2024)		Grade 5, $N = 80$, quasi-experimental; $t_{78} = 4.12$, $p < .05$ (Kaçar & Çakmak, 2020) Grade 11, $N = 36$, quasi-experimental (Astina et al., 2025) Grade 12, $N = 32$, quasi-experimental; $p < .001$ (Azmi & Kurniawan, 2025) Grade 10, $N = 71$, quasi-experimental (Setiyaningsih et al., 2024)
Scientific process skills	Grade = 8, $N = 257$, quasi-experimental; Cohen's $d = 0.46$ (Bónus et al., 2024)	No empirical evidence	
Problem-solving	Grade = 6, $N = 101$, quasi-experimental; $F = 5.55$, $p < .05$, $\eta^2 = 0.05$ (Hwang & Chen, 2017)	No empirical evidence	
Academic achievement	Meta-analysis, 36 studies; ES = 0.91 (Zheng et al., 2018)	Grade = 6, $N = 56$, quasi-experimental; $F = 4.36$, $p < .05$ (Hwang et al., 2013)	
Engagement and motivation	Grade = 8, $N = 90$, quasi-experimental; $t = 2.69$, $p = .009$ (Meng & Jumaat, 2024)	Grade = 11, $N = 29$, classroom action research (Meitriana et al., 2021)	
Conceptual understanding	Grade = 10–12, $N = 58$, quasi-experimental (Hermansyah et al., 2019)	No empirical evidence	
Digital competences	Grade 6, $N = 110$, quasi-experimental; ES = 2.55 (Yasa et al., 2024)	No empirical evidence	

Note. The natural science studies included are illustrative rather than comprehensive, as the primary focus was on social science research.

Whereas evidence of the effectiveness of digitally supported IBL in science disciplines is robust, it is limited in the social sciences. In addition to the low number of studies available, generalizability is further constrained by small sample sizes and the absence of control groups in several studies. These limitations reduce the reliability of the findings and make it difficult to draw robust conclusions about the effectiveness of digitally supported IBL in the social sciences. Moreover, given that IBL's effectiveness hinges on context and implementation, the existing evidence should be reviewed in relation to these conditions. Therefore, to better

understand its potential in business ethics education, it is essential to examine the factors that influence its effectiveness.

1.3.4 Factors influencing the effectiveness of digital inquiry-based learning

Differences in *students*, *teachers*, *content*, and *context* represent the four main categories that generally shape the successful implementation of instructional approaches, such as IBL (Hirsh et al., 2022).

Regarding *students*, several studies have highlighted their prior knowledge as a critical factor (e.g., Al Mamun et al., 2020; Lazonder et al., 2009). Learners who already possess some background knowledge before formulating hypotheses and research questions benefit more strongly from inquiry learning (Hattie & Donoghue, 2016). A certain degree of subject matter familiarity also facilitates the interpretation of data presented in tables and diagrams (Ho et al., 2014). Furthermore, learners require a basic understanding of the steps involved in the research process (Mäeots & Pedaste, 2014). Empirical findings also show that students with limited prior knowledge benefit particularly from targeted scaffolding during inquiry (Gerard et al., 2022; van Riesen et al., 2022).

Teacher guidance constitutes another central factor in the successful implementation of IBL (De Jong et al., 2023). A meta-analysis of 164 primary studies demonstrated that guided inquiry is more effective than unguided inquiry (Alfieri et al., 2011). This finding has been confirmed by further meta-analyses (Belland et al., 2017; Furtak et al., 2012; Lazonder & Harmsen, 2016), with evidence even suggesting that guidance can substantially increase the positive effects of inquiry-based approaches on learning outcomes (Lazonder & Harmsen, 2016). Analyses of the PISA 2015 dataset corroborate these results for large-scale samples (Aditomo & Klieme, 2020; Areepattamannil et al., 2020; Jerrim et al., 2019; Wang et al., 2022).

Beyond teacher support, *content* also plays a crucial role, as not every topic is equally suitable for inquiry learning (De Jong et al., 2023). A particularly complex subject matter that allows

examination from multiple scientific perspectives aligns well with the IBL approach. Authentic problems that embed learning in real-world contexts are especially conducive (Huber, 2013), provided they allow multiple interpretations or are prone to misconceptions (De Jong et al., 2023).

In addition to content, the *context* of implementation is also critical. This requires sufficient time to enable students to complete an entire inquiry cycle (e.g., Pedaste et al., 2015). Moreover, the learning environment should foster curiosity (Astina et al., 2025). In contrast, a strong exam orientation and high performance expectations may hinder this process (Crawford, 2007). Finally, opportunities to experience research as a social and collaborative endeavor are beneficial (Costes-Onishi et al., 2020), with digital technologies playing a particularly supportive role in this regard (Hillen & Landis, 2014).

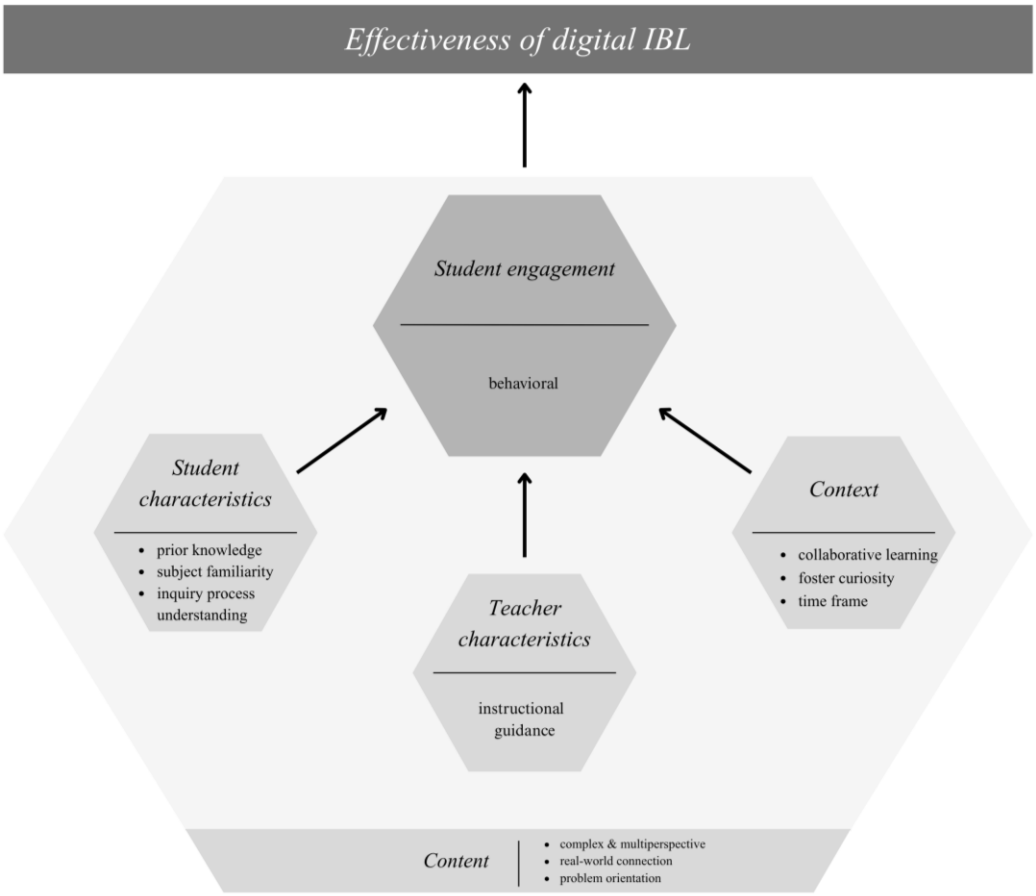
The factors relevant to analog IBL also play an important role in digitally implemented IBL. However, in the digital context, student engagement emerges as a predominant influencing factor (Meyer, 2014), particularly behavioral engagement (Al Mamun & Lawrie, 2023). Student engagement generally refers to the investment of time, energy, and effort in learning-related activities and comprises behavioral, cognitive, and emotional components (Henrie et al., 2015). Among these, behavioral engagement is regarded as a core element of learning engagement (Finn & Zimmer, 2012), referring to the frequency and quality of students' observable actions and interactions (Skinner & Pitzer, 2012). Empirical evidence consistently demonstrates a positive association between behavioral engagement and academic achievement (e.g., Bergdahl, 2022; Kahu & Nelson, 2018; Wang, 2017), with behavioral engagement shown to be a significant predictor of learning outcomes ($g = .430$; $p < .001$; $k = 175$) (Doo & Kim, 2024). Similar to analog IBL, findings in online contexts indicate that inexperienced learners lacking the necessary competencies for these environments tend to show lower levels of interest and engagement (Meyer, 2014). Moreover, in line with meta-analyses

on guided IBL, it has been shown that pedagogical guidance in online contexts significantly enhances behavioral engagement ($N = 30$; Cramer's $V = .48$) (Al Mamun & Lawrie, 2023). In addition, providing learning materials in multiple formats has been found to further promote student engagement (Miles et al., 2018).

Overall, the effectiveness of IBL appears to depend on several key factors: (1) students' prior knowledge, subject familiarity, and basic understanding of the research process; (2) the targeted guidance provided by the teacher; (3) the selection of complex, multiperspective, and problem-oriented content with real-life relevance; and (4) an adequate time frame combined with social interaction and the fostering of curiosity. In digitally implemented IBL, however, student engagement—particularly its behavioral dimension—emerges as a key overarching factor on which successful implementation critically depends. Similar to analog IBL, this engagement is substantially influenced by learners' prior knowledge, the instructional guidance provided by the teacher, and the manner in which learning content is presented across different formats. The content dimension remains a relevant factor in both analog and digital IBL. Figure 4 illustrates these interrelations and highlights the central role of student engagement.

Figure 4

Conceptual framework for factors influencing the effectiveness of digital IBL



Note. Content provides the foundation; four factors—student characteristics, teacher characteristics, context, and student engagement—influence the effectiveness of digital IBL; and student engagement is central.

1.4 Research questions and methodology

Economics and politics are inherently conflict-driven domains that require citizens capable of critically reflecting on competing interests and value-laden decisions. Business ethics, situated at the intersection of economic, social, and ethical perspectives, therefore represents an essential component of CE (Piller, 2016; Ulrich, 2012). The early integration of business ethics into secondary education contributes to the development of a stable moral orientation system among students (Babalola et al., 2023). Against this backdrop—and in light of unethical

behavior in both professional and educational contexts (Alonso & Schweiger-Gallo, 2022)—this dissertation focuses on business ethics in secondary education. The IBL approach is particularly well suited for conveying content in business ethics, as it promotes critical analytical thinking and problem-oriented learning (Hermidayani et al., 2019; Iacovidou et al., 2020). While the integration of digital technologies enhances these potentials—by promoting key 21st-century competencies (Nuraini et al., 2021), scientific competencies (Bónus et al., 2024), and digital skills (Gholam, 2019)—and by preparing students for active civic participation (Dwomoh, 2025), there remains a notable lack of empirical evidence on digital IBL in the social sciences. The effectiveness of digital learning environments largely depends on students' engagement (Meyer, 2014), which is shaped by individual, teacher-related, and contextual factors (Al Mamun et al., 2020; Meyer, 2014; Miles et al., 2018), with content providing the underlying foundation (Hirsh et al., 2022). Although digital learning environments are gaining increasing relevance in school settings, empirical findings at the secondary level remain scarce.

This dissertation addresses this research gap by providing one of the first systematic empirical examinations of digital IBL for business ethics in secondary education. It links business ethics, as a social science content area, with digital IBL, a methodologically and scientifically oriented approach, and examines their combined contribution to students' competence development, drawing on key influencing factors identified in the literature. In doing so, it helps integrate the previously separate research domains of business ethics education, IBL, and digitalization into the school context.

The first study focused on *student characteristics* as an influencing factor. To examine their prior knowledge, learners' existing conceptions of business ethical issues were qualitatively analyzed (Study 1). Building on these findings, a quantitative assessment was conducted to examine the effectiveness of digitally supported IBL for competence development (Study 2).

The inquiry process, supported by the teacher and the learning environment and designed to include sufficient time and a curiosity-stimulating digital environment, enabled a combined analysis of the influencing dimensions of *teacher characteristics* and *context*. The subsequent investigation focused on engagement, a factor central to the effectiveness of digital learning environments, and quantitatively analyzed students' behavioral engagement as well as its relationship with the development of business ethics competences (Study 3).

This dissertation provides an initial starting point for the systematic integration of the research domains of business ethics and digital IBL in secondary education. At the same time, it addresses the central influencing factors of the effectiveness of digital IBL to generate insights into how business ethical competencies can best be promoted at the secondary level. From this, three central research questions emerge:

(1) *Which conceptions do students have regarding business ethical issues in the context of secondary education?*

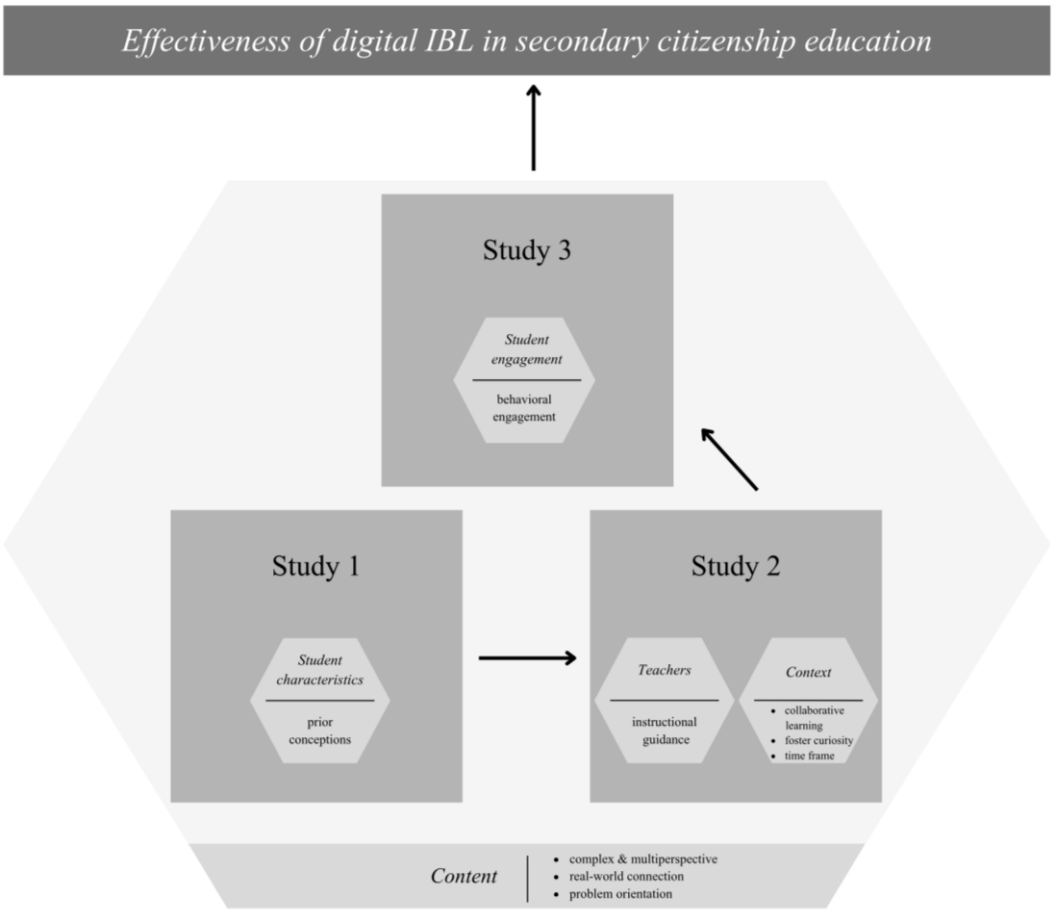
(2) *To what extent does digitally supported inquiry-based learning foster the development of students' business ethical competencies?*

(3) *How do students' engagement patterns in digital learning environments differ, and how are these patterns related to the development of business ethical competencies?*

These overarching research questions were addressed in three empirical studies. Figure 5 illustrates the systematic positioning of the studies and their coverage of key influencing factors.

Figure 5

Contextualization of the studies within the context of factors influencing the effectiveness of digital IBL in secondary citizenship education



Note. Content forms the basis; student characteristics, teachers, context, and student engagement represent the key influencing factors; and student engagement emerges as the most central factor affecting the effectiveness of digital IBL.

Study 1 (*Responsible behaviour in the context of utility maximisation – An interview study on pupils' business ethical conceptions*) investigated the conceptions of eighth-grade students[3] regarding business ethical issues through 33 semi-structured interviews (Estler & Brahm, 2025). The analysis of the interviews was conducted using a two-step procedure. First, a

[3] Study 1 employs the British English term *pupil* to refer to *student*. Studies 2 and 3, as well as all subsequent sections of this manuscript, use *student(s)*, given its wider international usage (Oxford University Press, n.d.). In both cases, the terms denote secondary-school learners.

deductive coding process captured both the level of elaboration (elaborated conception, fragmented conception, or no conception) and the ethical level (individual ethics, corporate ethics, or order ethics), based on an expected framework adapted from Aprea (2015). Second, a phenomenographic analysis, following Åkerlind (2005), was employed, which focused on identifying (a) what gives a consumer power or responsibility, (b) what this depends on, and (c) which misconceptions prevail.

Study 2 (*Exploring the impact of a digital inquiry-based learning environment on competence development in secondary economic education*) examined the development of business ethics competences among eighth-grade students through the digitally implemented IBL approach. The study employed a quasi-experimental, pre–post test design (N = 445) with experimental and control groups. Data were collected via a digital questionnaire that included both standardized scales and items derived from the findings of the first study. The intervention consisted of the use of a digital IBL platform over the course of one school semester. It was hypothesized, first, that the implementation would have positive effects on students' (economic) competences and promote a more critical perspective on economic issues, and second, that the effects of the implementation would differ by student gender. To test these hypotheses, regression analyses and multilevel models were employed.

Study 3 (*Engagement and learner behavior in a digital environment: Implications for secondary economic education*) built on the findings of the second study and focused on students' behavioral engagement within the digital IBL environment. Based on the learning analytics data of the experimental group from Study 2 (N = 285), four learner types were identified, following Li and Baker (2018): Disengagers, Auditors/Viewers, Quiz-Takers, and All-Rounders. By linking these data with questionnaire responses, behavioral and performance data were integrated. Using multilevel regressions, the extent to which engagement and different usage patterns were associated with learning outcomes was examined. Additionally,

profile analyses were conducted to explore the relationship between engagement types and learning outcomes.

The following chapters present the three studies in detail, followed by a summary and critical discussion of the results. Finally, the potential and limitations of the dissertation are reviewed, and implications for research and practice regarding the implementation of digital IBL in economic education are derived before the work concludes with a final summary.

1.5 References

Abu El-Haj, T. R. (2009). Becoming citizens in an era of globalization and transnational migration: Re-imagining citizenship as critical practice. *Theory into Practice*, *48*, 274–282.

Adams, E. C. (2019). Economics and the civic mission of social studies education: Two critiques of neoclassicism. *Citizenship, Social and Economics Education*, *18*(1), 16–32. https://doi.org/10.1177/2047173419841915

Aditomo, A., & Klieme, E. (2020). Forms of inquiry-based science instruction and their relations with learning outcomes: Evidence from high and low-performing education systems. *International Journal of Science Education*, *42*(4), 504–525. https://doi.org/10.1080/09500693.2020.1716093

Åkerlind, G. S. (2005). Variation and commonality in phenomenographic research methods. *Higher Education Research & Development*, *24*(4), 321–334. https://doi.org/10.1080/07294360500284672

Al Mamun, M. A., & Lawrie, G. (2023). Student-content interactions: Exploring behavioural engagement with self-regulated inquiry-based online learning modules. *Smart Learning Environments*, *10*(1), 1. https://doi.org/10.1186/s40561-022-00221-x

Al Mamun, M. A., Lawrie, G., & Wright, T. (2020). Instructional design of scaffolded online learning modules for self-directed and inquiry-based learning environments. *Computers & Education*, *144*, 103695. https://doi.org/10.1016/j.compedu.2019.103695

Alfieri, L., Brooks, P. J., Aldrich, N. J., & Tenenbaum, H. R. (2011). Does discovery-based instruction enhance learning? *Journal of Educational Psychology*, *103*(1), 1–18. https://doi.org/10.1037/a0021017

Alonso, M. A., & Schweiger-Gallo, I. (2022). Validación de una escala de conductas éticas en la educación secundaria y superior: La Escala de Ética en Escenarios Educativos

(EEEE). *Revista Iberoamericana de Diagnóstico y Evaluación – e Avaliação Psicológica*, *63*(2), 119. https://doi.org/10.21865/RIDEP63.2.09

Alonso, M. A., & Schweiger-Gallo, I. (2025). Ethical behavior intervention through group activities in secondary education. *Psychology in the Schools*, *62*(3), 931–940. https://doi.org/10.1002/pits.23366

Amagir, A., Groot, W., Maassen Van Den Brink, H., & Wilschut, A. (2018). A review of financial-literacy education programs for children and adolescents. *Citizenship, Social and Economics Education*, *17*(1), 56–80. https://doi.org/10.1177/2047173417719555

Anugrah, A., Anggraeni, L., & Syaifullah, S. (2025). Inquiry-based learning and its impact on critical thinking: An empirical analysis. *The Eurasia Proceedings of Educational and Social Sciences*, *42*, 70–80. https://doi.org/10.55549/epess.912

Aprea, C. (2015). Secondary school students' informal conceptions of complex economic phenomena. *International Journal of Educational Research*, *69*, 12–22. https://doi.org/10.1016/j.ijer.2014.09.002

Areepattamannil, S., Cairns, D., & Dickson, M. (2020). Teacher-directed versus inquiry-based science instruction: Investigating links to adolescent students' science dispositions across 66 countries. *Journal of Science Teacher Education*, *31*(6), 675–704. https://doi.org/10.1080/1046560X.2020.1753309

Aßländer, M. S. (2022). Die wirtschafts- und unternehmensethische Debatte im deutschsprachigen Raum. In M. S. Aßländer (Ed.), *Handbuch Wirtschaftsethik* (pp. 243–249). J.B. Metzler. https://doi.org/10.1007/978-3-476-05806-5_22

Astina, Hafid, R., Maruwae, A., Bumulo, F., & Dama, M. N. (2025). The effect of inquiry-based learning on the critical thinking skills of eleventh-grade social science students in economics. *International Journal of Research in Education*, *5*(2), 218–230.

Avsec, S., Rihtarsic, D., & Kocijancic, S. (2014). A predictive study of learner attitudes toward open learning in a robotics class. *Journal of Science Education and Technology*, *23*(5), 692–704. https://doi.org/10.1007/s10956-014-9496-6

Azmi, R. H. U., & Kurniawan, R. Y. (2025). Empowering student critical thinking skills: How guided inquiry enhances critical skills in economics. *Jurnal Eduscience*, *12*(1), 37–49. https://doi.org/10.36987/jes.v12i1.6560

Babalola, F. I., Oriji, O., Oladayo, G. O., Abitoye, O., & Daraojimba, C. (2023). Integrating ethics and professionalism in accounting education for secondary school students. *International Journal of Management & Entrepreneurship Research*, *5*(12), 863–878. https://doi.org/10.51594/ijmer.v5i12.622

Banks, J. A. (2001). Citizenship education and diversity: Implications for teacher education. *Journal of Teacher Education*, *52*(1), 5–16. https://doi.org/10.1177/0022487101052001002

Beißert, H. M., & Hasselhorn, M. (2016). Individual differences in moral development: Does intelligence really affect children's moral reasoning and moral emotions? *Frontiers in Psychology*, *7*. https://doi.org/10.3389/fpsyg.2016.01961

Belland, B. R., Walker, A. E., Kim, N. J., & Lefler, M. (2017). Synthesizing results from empirical research on computer-based scaffolding in STEM education: A meta-analysis. *Review of Educational Research*, *87*(2), 309–344. https://doi.org/10.3102/0034654316670999

Bergdahl, N. (2022). Engagement and disengagement in online learning. *Computers & Education*, *188*, 104561. https://doi.org/10.1016/j.compedu.2022.104561

Beswick, K. (2021). Inquiry-based approaches to mathematics learning, teaching, and mathematics education research. *Journal of Mathematics Teacher Education*, *24*(2), 123–126. https://doi.org/10.1007/s10857-021-09494-4

Bieling, H.-J., & Salomon, D. (2022). Politische Ökonomie des globalisierten Kapitalismus. In H.-J. Bieling, B. Ewert, M. Haus, M. Oberle, & A. Wohnig (Eds.), *Politikwissenschaft trifft Politikdidaktik* (pp. 15–27). Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-36829-6_2

Bónus, L., Antal, E., & Korom, E. (2024). Digital game-based inquiry learning to improve eighth graders' inquiry skills in biology. *Journal of Science Education and Technology*, *33*, 462–478. https://doi.org/10.1007/s10956-024-10096-x

Bosio, E., & Schattle, H. (2023). Ethical global citizenship education: From neoliberalism to a values-based pedagogy. *Prospects*, *53*(3–4), 287–297. https://doi.org/10.1007/s11125-021-09571-9

Bremer, H., & Gerdes, J. (2022). Politische Bildung. In U. Bauer, U. H. Bittlingmayer, & A. Scherr (Eds.), *Handbuch Bildungs- und Erziehungssoziologie* (pp. 895–917). Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-30903-9_51

Bruce, B. C., & Casey, L. (2012). The practice of inquiry: A pedagogical "sweet spot" for digital literacy? *Computers in the Schools*, *29*(1–2), 191–206. https://doi.org/10.1080/07380569.2012.657994

Bruder, R., & Prescott, A. (2013). Research evidence on the benefits of IBL. *ZDM*, *45*(6), 811–822. https://doi.org/10.1007/s11858-013-0542-2

Bull, B. L. (2006). Can civic and moral education be distinguished? In D. Warren & J. J. Patrick (Eds.), *Civic and Moral Learning in America* (pp. 21–31). Palgrave Macmillan US. https://doi.org/10.1057/9781403984722_3

Campion, M. A., Fink, A. A., Ruggeberg, B. J., Carr, L., Phillips, G. M., & Odman, R. B. (2011). Doing competencies well: Best practices in competency modeling. *Personnel Psychology*, *64*(1), 225–262. https://doi.org/10.1111/j.1744-6570.2010.01207.x

Carretero, M., Haste, H., & Bermudez, A. (2015). Civic education. In L. Corno & E. M. Anderman (Eds.), *Handbook of educational psychology* (3rd ed., pp. 295–308). Routledge. https://doi.org/10.4324/9781315688244

Caswell, C., & LaBrie, D. (2017). Inquiry based learning from the learner's point of view: A teacher candidate's success story. *Journal of Humanistic Mathematics*, *7*(2), 161–186. https://doi.org/10.5642/jhummath.201702.08

Chang, C., Chang, C.-K., & Shih, J.-L. (2016). Motivational strategies in a mobile inquiry-based language learning setting. *System*, *59*, 100–115. https://doi.org/10.1016/j.system.2016.04.013

Chen, K., Shao, A., Burapacheep, J., & Li, Y. (2023). *How GPT-3 responds to different publics on climate change and Black Lives Matter: A critical appraisal of equity in conversational AI.* arXiv preprint arXiv:2209.13627.

Costes-Onishi, P., Baildon, M., & Aghazadeh, S. (2020). Moving inquiry-based learning forward: A meta-synthesis on inquiry-based classroom practices for pedagogical innovation and school improvement in the humanities and arts. *Asia Pacific Journal of Education*, *40*(4), 552–575. https://doi.org/10.1080/02188791.2020.1838883

Crawford, B. A. (2007). Learning to teach science as inquiry in the rough and tumble of practice. *Journal of Research in Science Teaching*, *44*(4), 613–642. https://doi.org/10.1002/tea.20157

De George, R. T. (1999). *Business ethics* (5th ed.). Prentice Hall.

De Jong, T., Lazonder, A. W., Chinn, C. A., Fischer, F., Gobert, J., Hmelo-Silver, C. E., Koedinger, K. R., Krajcik, J. S., Kyza, E. A., Linn, M. C., Pedaste, M., Scheiter, K., & Zacharia, Z. C. (2023). Let's talk evidence – The case for combining inquiry-based and direct instruction. *Educational Research Review*, *39*, 100536. https://doi.org/10.1016/j.edurev.2023.100536

De Jong, T., Sotiriou, S., & Gillet, D. (2014). Innovations in STEM education: The Go-Lab federation of online labs. *Smart Learning Environments*, *1*(1), 3. https://doi.org/10.1186/s40561-014-0003-6

Deichmann, C. (2004). *Lehrbuch Politikdidaktik.* De Gruyter. https://doi.org/10.1515/9783486599244

Department for Education and Employment. (2013). *National curriculum in England: Citizenship programmes of study for key stages 3 and 4*.

Detjen, J., Kuhn, H.-W., Massing, P., Richter, D., Sander, W., & Weißeno, G. (2004). *Anforderungen an nationale Bildungsstandards für den Fachunterricht in der Politischen Bildung an Schulen: Ein Entwurf* (2nd ed.). Wochenschau-Verlag.

Doo, M. Y., & Kim, J. (2024). The relationship between learning engagement and learning outcomes in online learning in higher education: A meta-analysis study. *Distance Education*, *45*(1), 60–82. https://doi.org/10.1080/01587919.2024.2303484

Dooly, M., & Darvin, R. (2022). Intercultural communicative competence in the digital age: Critical digital literacy and inquiry-based pedagogy. *Language and Intercultural Communication*, *22*(3), 354–366. https://doi.org/10.1080/14708477.2022.2063304

Dubs, R. (2001). Wirtschaftsbürgerliche Bildung: Überlegungen zu einem alten Postulat. *Sowi-Onlinejournal*, *2*.

Dwomoh, R. K. (2025). The impact of technology on inquiry in citizenship education. In J. Zajda & A. Rapoport (Eds.), *Discourses of globalisation and sitizenship education* (Vol. 46, pp. 51–68). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-86145-1_4

Egtved, P. (Ed.). (2023). Logik des digital-forschenden Lernens im Politik- und Wirtschaftsunterricht. In *Politische Mündigkeit durch digital-forschendes Lernen im*

Politikunterricht (pp. 9–130). Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-40075-0_2

Ekström, L., & Lundholm, C. (2021). "How much politics is there"?: Exploring students' experiences of values and impartiality from an epistemic perspective. *Journal of Political Science Education*, *17*(sup1), 616–633. https://doi.org/10.1080/15512169.2020.1730863

Engartner, T., Hedtke, R., & Zurstrassen, B. (2021). *Sozialwissenschaftliche Bildung: Politik - Wirtschaft - Gesellschaft*. Ferdinand Schöningh. https://doi.org/10.36198/9783838553962

Estler, V., & Brahm, T. (2025). Responsible behaviour in the context of utility maximisation – An interview study on pupils' business ethics conceptions. *Social Sciences & Humanities Open*, *11*, 101386. https://doi.org/10.1016/j.ssaho.2025.101386

European Commission (Ed.). (2007). *Science education now: A renewed pedagogy for the future of Europe.* Office des publications officielles des Communautés européennes.

Finn, J. D., & Zimmer, K. S. (2012). Student engagement: What is it? Why does it matter? In S. L. Christenson, A. L. Reschly, & C. Wylie (Eds.), *Handbook of research on student engagement* (pp. 97–131). Springer US. https://doi.org/10.1007/978-1-4614-2018-7_5

Franklin, B. (n.d.). *Tell me and I forget, show me and I remember, involve me and I understand.* Attributed quotation.

Freeman, R. E., Harrison, J. S., Wicks, A. C., Parmar, B. L., & De Colle, S. (2010). *Stakeholder theory: The state of the art* (1st ed.). Cambridge University Press. https://doi.org/10.1017/CBO9780511815768

Fridrich, C., Hagedorn, U., Hedtke, R., Mittnik, P., & Tafner, G. (Eds.). (2024). *Economy, society, and politics: Socio-economic and political education in schools and*

universities. Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-42525-8

Furtak, E. M., Seidel, T., Iverson, H., & Briggs, D. C. (2012). Experimental and quasi-experimental studies of inquiry-based science teaching: A meta-analysis. *Review of Educational Research*, *82*(3), 300–329. https://doi.org/10.3102/0034654312457206

Gerard, L., Linn, M. C., & Berkeley, U. C. (2022). Computer-based guidance to support students' revision of their science explanations. *Computers & Education*, *176*, 104351. https://doi.org/10.1016/j.compedu.2021.104351

Gholam, A. P. (2019). Inquiry-based learning: Student teachers' challenges and perceptions. *Journal of Inquiry and Action in Education*, *10*(2), 112–133.

Gilbert, D. U., Rasche, A., & Waddock, S. (2011). Accountability in a global economy: The emergence of international accountability standards. *Business Ethics Quarterly*, *21*(1), 23–44. https://doi.org/10.5840/beq20112112

Grammes, T. (2006). Unterrichtsmodelle Wirtschaft und Politik. In G. Weißeno (Ed.), *Politik und Wirtschaft unterrichten* (pp. 232–246). VS Verlag für Sozialwissenschaften. https://doi.org/10.1007/978-3-531-90312-5_15

Haarmann, M. P. (2020). Politische Ökonomie: Eine für angehende Lehrkräfte der politischen Bildung didaktisch rekonstruierte Volkswirtschaftslehre. In C. Fridrich, R. Hedtke, & W. O. Ötsch (Eds.), *Grenzen überschreiten, Pluralismus wagen – Perspektiven sozioökonomischer Hochschullehre* (pp. 243–263). Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-29642-1_13

Hattie, J. A. C., & Donoghue, G. M. (2016). Learning strategies: A synthesis and conceptual model. *NPJ Science of Learning*, *1*(1), 16013. https://doi.org/10.1038/npjscilearn.2016.13

Hedtke, R. (2015). Wissenschaftsorientierung und Kontroversität in der ökonomischen Bildung. *GWP – Gesellschaft. Wirtschaft. Politik*, *64*(4), 445–450. https://doi.org/10.3224/gwp.v64i4.21143

Hedtke, R. (2019). Wirtschaft ohne Politik? Zur Entpolitisierung der ökonomischen Bildung. *Polis*, *23*(3), 11–13.

Heidenreich, F. (2012). *Wirtschaftsethik zur Einführung*. Junius.

Henrie, C. R., Halverson, L. R., & Graham, C. R. (2015). Measuring student engagement in technology-mediated learning: A review. *Computers & Education*, *90*, 36–53. https://doi.org/10.1016/j.compedu.2015.09.005

Hermansyah, H., Gunawan, G., Harjono, A., & Adawiyah, R. (2019). Guided inquiry model with virtual labs to improve students' understanding on heat concept. *Journal of Physics: Conference Series*, *1153*, 012116. https://doi.org/10.1088/1742-6596/1153/1/012116

Hermidayani, H., Mukhtar, M., & Tambunan, H. (2019). The effect of learning model and critical thinking toward learning outcome in economics of the tenth graders in senior high school. In *Proceedings of the 2nd Annual Conference of Engineering and Implementation on Vocational Education (ACEIVE 2018), November 3, 2018, North Sumatra, Indonesia*. https://doi.org/10.4108/eai.3-11-2018.2285666

Hernández-Serrano, M. J. (Ed.). (2021). *Teacher education in the 21st century – Emerging skills for a changing world*. IntechOpen. https://doi.org/10.5772/intechopen.91070

Hillen, S. A., & Landis, M. (2014). Two perspectives on e-learning design: A synopsis of a U.S. and a European analysis. *The International Review of Research in Open and Distributed Learning*, *15*(4). https://doi.org/10.19173/irrodl.v15i4.1783

Hirsh, Å., Nilholm, C., Roman, H., Forsberg, E., & Sundberg, D. (2022). Reviews of teaching methods – Which fundamental issues are identified? *Education Inquiry*, *13*(1), 1–20. https://doi.org/10.1080/20004508.2020.1839232

Ho, H. N. J., Tsai, M.-J., Wang, C.-Y., & Tsai, C.-C. (2014). Prior knowledge and online inquiry-based science reading: Evidence from eye tracking. *International Journal of Science and Mathematics Education*, *12*(3), 525–554. https://doi.org/10.1007/s10763-013-9489-6

Hofhues, S. (2019). Inquiry-based learning with digital media. In H. A. Mieg (Ed.), *Inquiry-based learning – Undergraduate research* (pp. 375–382). Springer International Publishing. https://doi.org/10.1007/978-3-030-14223-0_35

Homann, K., & Blome-Drees, F. (1992). *Wirtschafts- und Unternehmensethik* (Vol. 1721). Vandenhoeck & Ruprecht.

Huber, L. (2013). Warum Forschendes Lernen nötig und möglich ist. In L. Huber, J. Hellmer, & F. Schneider (Eds.), *Forschendes Lernen im Studium: Aktuelle Konzepte und Erfahrungen* (2nd ed., pp. 9–36). Universitäts Verlag Webler.

Hwang, G., & Chen, C. (2017). Influences of an inquiry-based ubiquitous gaming design on students' learning achievements, motivation, behavioral patterns, and tendency towards critical thinking and problem solving. *British Journal of Educational Technology*, *48*(4), 950–971. https://doi.org/10.1111/bjet.12464

Hwang, G. J., Wu, P. H., Zhuang, Y. Y., & Huang, Y. M. (2013). Effects of the inquiry-based mobile learning model on the cognitive load and learning achievement of students. *Interactive Learning Environments*, *21*(4), 338–354. https://doi.org/10.1080/10494820.2011.575789

Iacovidou, E., Hahladakis, J. N., & Purnell, P. (2020). A systems thinking approach to understanding the challenges of achieving the circular economy. *Environmental*

Science and Pollution Research, *28*(19), 24785–24806. https://doi.org/10.1007/s11356-020-11725-9

Ignell, C., Davies, P., & Lundholm, C. (2017). "Understanding price" and the environment: Exploring upper secondary students' conceptual development. *Journal of Social Science Education*, *16(1)*, 68–80. https://doi.org/10.4119/UNIBI/JSSE-V16-I1-1556

Inel-Ekici, D., & Ekici, M. (2022). Mobile inquiry and inquiry-based science learning in higher education: Advantages, challenges, and attitudes. *Asia Pacific Education Review*, *23*(3), 427–444. https://doi.org/10.1007/s12564-021-09729-2

Ivanov, S. (2016). Hamburger Evaluationsstudien an Stadtteilschulen. In D. Benner & R. Nikolova (Eds.), *Ethisch-moralische Kompetenz als Teil öffentlicher Bildung: Der Berliner Ansatz zur Konstruktion und Erhebung ethisch-moralischer Kompetenzniveaus im öffentlichen Erziehungs- und Bildungssystem mit einem Ausblick auf Projekte zu ETiK-International* (pp. 180–187). Ferdinand Schöningh. https://doi.org/10.30965/9783657785964

Jaganjac, B., Abrahamsen, L. M., Olsen, T. S., & Hunnes, J. A. (2024). Is it time to reclaim the "ethics" in business ethics education? *Journal of Business Ethics*, *190*(1), 1–22. https://doi.org/10.1007/s10551-023-05400-5

Jami, D. Z., & Muharam, A. (2022). Strategy for improving the quality of Islamic religious education study programs with total quality management. *Nidhomul Haq: Jurnal Manajemen Pendidikan Islam*, *7*(2), 267–283. https://doi.org/10.31538/ndh.v7i2.2096

Jerrim, J., Oliver, M., & Sims, S. (2019). The relationship between inquiry-based teaching and students' achievement. New evidence from a longitudinal PISA study in England. *Learning and Instruction*, *61*, 35–44. https://doi.org/10.1016/j.learninstruc.2018.12.004

Juchler, I. (2021). Wissenschaftstheoretische Grundlagen politischer Bildung: Hermeneutik. In W. Sander & K. Pohl (Eds.), *Handbuch politische Bildung* (5th ed., pp. 63–74). Wochenschau Verlag. https://doi.org/10.46499/1694

Kaçar, T., & Çakmak, Z. (2020). Sosyal bilgiler dersinde sorgulamaya dayali öğretimin öğrencilerin ders başarisina, eleştirel düşünme becerilerine ve öğrenmenin kaliciliğina etkisi. *Elektronik Sosyal Bilimler Dergisi*, *19*(76), 1651–1672. https://doi.org/10.17755/esosder.712886

Kahu, E. R., & Nelson, K. (2018). Student engagement in the educational interface: Understanding the mechanisms of student success. *Higher Education Research & Development*, *37*(1), 58–71. https://doi.org/10.1080/07294360.2017.1344197

Kaiser, T., Birke, F., & Lutter, A. (2015). Schülerkonzepte zu ordnungspolitischen Fragen: Eine phänomenographische Untersuchung. *Zeitschrift Für Didaktik Der Gesellschaftswissenschaften*, *1*(6), 92–110.

Kelly, D. M., & Brooks, M. (2009). How young is too young? Exploring beginning teachers' assumptions about young children and teaching for social justice. *Equity & Excellence in Education*, *42*(2), 202–216. https://doi.org/10.1080/10665680902739683

Kenner, S. (2020). Politische Bildung. Citizenship education in Germany from marginalization to new challenges. *Journal of Social Science Education*, *19*(1), 118–135. https://doi.org/10.4119/JSSE-1618

Kenner, S., & Lange, D. (2019). Schule als Lernort der Demokratie. *Zeitschrift Für Pädagogik Und Theologie*, *71*(2), 120–130. https://doi.org/10.1515/zpt-2019-0017

Kersting, M., Karlsen, S., Ødegaard, M., Olufsen, M., Kjærnsli, M., & Suhr Lunde, M. L. (2023). Studying the quality of inquiry-based teaching in science classrooms. A systematic video study of inquiry-based science teaching in primary and lower-

secondary schools. *International Journal of Science Education*, *45*(17), 1463–1484. https://doi.org/10.1080/09500693.2023.2213386

Kleinschmidt, M., Fischer, S., Fischer, F., & Lange, D. (2015). Globalisierung, globale Ungleichheit und Entwicklung in den Vorstellungen von Schüler/inne/n. Die empirische Untersuchung von Lernvoraussetzungen als Ausgangspunkt für die Gestaltung Globalen Lernens. *Zeitschrift für internationale Bildungsforschung und Entwicklungspädagogik*, *38*(3), 26–30. https://doi.org/10.25656/01:14055

Kohlberg, L. (1975). The cognitive-developmental approach to moral education. *The Phi Delta Kappan*, *56*(10), 670–677.

Koyunlu Ünlü, Z., & Dökme, İ. (2020). The Effect of Technology-Supported Inquiry-Based Learning in Science Education: Action Research. *Journal of Education in Science, Environment and Health*, *6*(2), 120–133. https://doi.org/10.21891/jeseh.632375

Lameras, P., Arnab, S., De Freitas, S., Petridis, P., & Dunwell, I. (2021). Science teachers' experiences of inquiry-based learning through a serious game: A phenomenographic perspective. *Smart Learning Environments*, *8*(1), 7. https://doi.org/10.1186/s40561-021-00152-z

Lau, C. L. L. (2010). A step forward: Ethics education matters! *Journal of Business Ethics*, *92*(4), 565–584. https://doi.org/10.1007/s10551-009-0173-2

Lazonder, A. W., & Harmsen, R. (2016). Meta-analysis of inquiry-based learning: Effects of uidance. *Review of Educational Research*, *86*(3), 681–718. https://doi.org/10.3102/0034654315627366

Lazonder, A. W., Wilhelm, P., & Van Lieburg, E. (2009). Unraveling the influence of domain knowledge during simulation-based inquiry learning. *Instructional Science*, *37*(5), 437–451. https://doi.org/10.1007/s11251-008-9055-8

Leite, S. (2022). Using the SDGs for global citizenship education: Definitions, challenges, and opportunities. *Globalisation, Societies and Education*, *20*(3), 401–413. https://doi.org/10.1080/14767724.2021.1882957

Levy, P., Little, S., McKinney, P., Nibbs, A., & Wood, J. (2010). *The Sheffield companion to inquiry-based learning*. University of Sheffield.

Li, Q., & Baker, R. (2018). The different relationships between engagement and outcomes across participant subgroups in massive open online courses. *Computers & Education*, *127*, 41–65. https://doi.org/10.1016/j.compedu.2018.08.005

Lin, L.-F., Hsu, Y.-S., & Yeh, Y.-F. (2012). The role of computer simulation in an inquiry-based learning environment: Reconstructing geological events as geologists. *Journal of Science Education and Technology*, *21*(3), 370–383. https://doi.org/10.1007/s10956-011-9330-3

Liu, C., Bano, M., Zowghi, D., & Kearney, M. (2021). Analysing user reviews of inquiry-based learning apps in science education. *Computers & Education*, *164*, 104119. https://doi.org/10.1016/j.compedu.2020.104119

Loerwald, D. (2010). Wirtschaftsethik im Ökonomieunterricht. Zum Spannungsverhältnis von ethischer Ökonomie und ökonomischer Ethik aus wirtschaftsdidaktischer Sicht. In A. Fischer & G. Hahn (Eds.), *Schule – Der Zukunft voraus. Was wäre, wenn...? Lese- und Lehrbuch für zukunftsorientierte Ansätze in der beruflichen Bildung*. Schneider-Verlag Hohengehren.

Lütge, C., & Uhl, M. (2021). *Business ethics: An economically informed perspective* (1st ed.). Oxford University Press. https://doi.org/10.1093/oso/9780198864776.001.0001

MacDonald, M. N. (2019). Editorial. *Language and Intercultural Communication*, *19*(6), 445–450. https://doi.org/10.1080/14708477.2019.1677292

Mäeots, M., & Pedaste, M. (2014). The role of general inquiry knowledge in enhancing students' transformative inquiry processes in a web-based learning environment. *Journal of Baltic Science Education*, *13*(1), 19–31. https://doi.org/10.33225/jbse/14.13.19

Mahat, H., Norkhaidi, S. B., Saleh, Y., Hashim, M., Nayan, N., Said, Z. M., Matnoor, M., & Hamid, N. (2022). A study on the responsibility of environmental ethics among secondary school students in the 21st century. *International Journal of Educational Methodology*, *8*(3), 585–593. https://doi.org/10.12973/ijem.8.3.585

Malone, D. M. (2020). Ethics education in teacher preparation: A case for stakeholder responsibility. *Ethics and Education*, *15*(1), 77–97. https://doi.org/10.1080/17449642.2019.1700447

Marks, D. B. (2013). Inquiry-based learning: What's your question? *National Teacher Education Journal*, *6*(2), 21–25.

Martini, M., Cavenago, D., & Carminati, M. (2025). Can business ethics courses be effective? A quasi-experimental mixed-methods study of a cooperative-learning approach in higher education. *Journal of Business Ethics*. https://doi.org/10.1007/s10551-025-05948-4

Maxwell, D. O., Lambeth, D. T., & Cox, J. T. (2015). Effects of using inquiry-based learning on science achievement for fifth-grade students. *Asia-Pacific Forum on Science Learning and Teaching*, *16*(1).

Medeiros, K. E., Watts, L. L., Mulhearn, T. J., Steele, L. M., Mumford, M. D., & Connelly, S. (2017). What is working, what is not, and what we need to know: A meta-analytic review of business ethics instruction. *Journal of Academic Ethics*, *15*(3), 245–275. https://doi.org/10.1007/s10805-017-9281-2

Meitriana, M. A., Irwansyah, M. R., & Suwena, K. R. (2021). Inquiry learning: Strategy to improve economic learning outcomes and student activities. *Journal of Research & Method in Education*, *11*(1), 35–41.

Meng, F., & Jumaat, N. F. B. (2024). The Effectiveness of an online inquiry-based learning environment towards secondary school students' behavioral engagement and performance in science. *International Journal of Interactive Mobile Technologies*, *18*(18), 112–124. https://doi.org/10.3991/ijim.v18i18.50547

Meyer, K. A. (2014). Student engagement in online learning: What works and why. *ASHE Higher Education Report*, *40*(6), 1–114. https://doi.org/10.1002/aehe.20018

Miles, D., Mensinga, J., & Zuchowski, I. (2018). Harnessing opportunities to enhance the distance learning experience of MSW students: An appreciative inquiry process. *Social Work Education*, *37*(6), 705–717. https://doi.org/10.1080/02615479.2018.1447557

Ministerium für Kultus, Jugend und Sport Baden-Württemberg. (2016). *Bildungsplan des Gymnasiums. Wirtschaft / Beruf- und Studienorientierung (WBS)*. https://www.bildungsplaene-bw.de/,Lde/LS/BP2016BW/ALLG/GYM/WBS

Moegling, K. (2012). Ökonomische Bildung im Politikunterricht? Ja – Aber aus der Perspektive der Politikdidaktik! *Politik Unterrichten*, *27*(2), 1–4.

Montiel, I., Delgado-Ceballos, J., Ortiz-de-Mandojana, N., & Antolin-Lopez, R. (2020). New ways of teaching: Using technology and mobile apps to educate on societal grand challenges. *Journal of Business Ethics*, *161*(2), 243–251. https://doi.org/10.1007/s10551-019-04184-x

Moon, J., Crane, A., & Matten, D. (2005). Can corporations be citizens? Corporate citizenship as a metaphor for business participation in society. *Business Ethics Quarterly*, *15*(3), 429–453. https://doi.org/10.5840/beq200515329

Muleya, G. (2018). Civic education versus citizenship education: Where is the point of convergence? *Journal of Lexicography and Terminology*, *2*(1), 109–130.

Münch, T. (2015). *Die Wirkmächtigkeit unternehmensethischer Managementkonzepte: Qualitative Fallanalysen*. Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-10565-5

Mutlu, A. (2020). Evaluation of students' scientific process skills through reflective worksheets in the inquiry-based learning environments. *Reflective Practice*, *21*(2), 271–286. https://doi.org/10.1080/14623943.2020.1736999

National Research Council. (2000). *Inquiry and the national science education standards: A guide for teaching and learning* (p. 9596). National Academies Press. https://doi.org/10.17226/9596

Nikolova, R. (2016). Systematische Befunde zu Einstellungen und Überzeugungen von Schülerinnen und Schülern unter Berücksichtigung ihrer ethisch-moralischen Kompetenzen. In D. Benner & R. Nikolova (Eds.), *Ethisch-moralische Kompetenz als Teil öffentlicher Bildung: Der Berliner Ansatz zur Konstruktion und Erhebung ethisch-moralischer Kompetenzniveaus im öffentlichen Erziehungs- und Bildungssystem mit einem Ausblick auf Projekte zu ETiK-International* (pp. 159–175). Ferdinand Schöningh. https://doi.org/10.30965/9783657785964

Nováková, P., Němejc, K., & Dytrtová, R. (2018). *A responsible consumer of the 21st century as a part of environmental education at secondary vocational schools: A design of a curricular topic*. Institute of Education and Communication, CULS Prague. https://doi.org/10.21125/iceri.2018.0421

Nuraini, U., Restuningdiah, N., Sidharta, E. A., & Utami, H. (2021). *Research-based learning to improve students' critical thinking skills in studying business ethics:* International

Conference on Strategic Issues of Economics, Business and, Education (ICoSIEBE 2020), Medan, Indonesia. https://doi.org/10.2991/aebmr.k.210220.033

Nussbaum, M. C. (2006). Education and democratic citizenship: Capabilities and quality education. *Journal of Human Development*, *7*(3), 385–395. https://doi.org/10.1080/14649880600815974

OECD. (2021). *OECD digital education outlook 2021: Pushing the frontiers with artificial intelligence, blockchain, and robots*. https://doi.org/10.1787/589b283f-en

Okechukwu Ugwuozor, F., & Otu, M. S. (2020). Effect of exposure to business ethics courses on students' perceptions of the linkage between ethics education and corporate social responsibility. *Journal of Education for Business*, *95*(4), 242–247. https://doi.org/10.1080/08832323.2019.1646698

Oxford University Press. (n.d.). *Pupil*. Oxford Learner's Dictionaries. https://www.oxfordlearnersdictionaries.com/definition/english/pupil

Palazzo, B., & Palazzo, G. (2011). Anglo-amerikanische Ansätze der Wirtschafts-und Unternehmensethik. In M. S. Aßländer (Ed.), *Handbuch Wirtschaftsethik* (pp. 132–137). J.B. Metzler.

Parks-Leduc, L., Mulligan, L., & Rutherford, M. A. (2021). Can ethics be taught? Examining the impact of distributed ethical training and individual characteristics on ethical decision-making. *Academy of Management Learning & Education*, *20*(1), 30–49. https://doi.org/10.5465/amle.2018.0157

Pasternack, P. (2019). Concepts and case studies: The state of higher education research on inquiry-based learning. In H. A. Mieg (Ed.), *Inquiry-based learning – Undergraduate research* (pp. 19–26). Springer International Publishing. https://doi.org/10.1007/978-3-030-14223-0_2

Pedaste, M., Mäeots, M., Siiman, L. A., de Jong, T., van Riesen, S. A. N., Kamp, E. T., Manoli, C. C., Zacharia, Z. C., & Tsourlidaki, E. (2015). Phases of inquiry-based learning: Definitions and the inquiry cycle. *Educational Research Review*, *14*, 47–61. https://doi.org/10.1016/j.edurev.2015.02.003

Penner, J., & Sanderse, J. (2017). The role of economic citizenship education in advancing global citizenship. *Policy & Practice: A Development Education Review*, *24*, 138–158.

Peters, J. M., & Stout, D. L. (2011). *Science in elementary education: Methods, concepts, and inquiries* (11th ed.). Pearson/Allyn & Bacon.

Piller, S. (2015). Homo oeconomicus: Fluch oder Segen für die politische Bildung? In I. Juchler (Ed.), *Hermeneutische Politikdidaktik* (pp. 11–23). Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-05740-4_2

Piller, S. (2016). *Wirtschaft im Politikunterricht: Ökonomie, Ökonomische Bildung und Institutionenökonomik*. Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-10579-2

Prayogi, S., Ahzan, S., Indriaturrahmi, I., & Rokhmat, J. (2022). Opportunities to stimulate the critical thinking performance of preservice science teachers through the ethno-inquiry model in an e learning platform. *International Journal of Learning, Teaching and Educational Research*, *21*(9), 134–153. https://doi.org/10.26803/ijlter.21.9.8

Prihatin, R., Sukmawati, F., Cahyono, B. T., Santosa, E. B., Juwita, R., & Suparmi. (2024). The effect of PJBL and IBL on the learning independence of vocational school students. *Tafkir: Interdisciplinary Journal of Islamic Education*, *5*(4), 598–611. https://doi.org/10.31538/tijie.v5i4.1171

Rahmi, Y. L., Alberida, H., & Astuti, M. Y. (2019). Enhancing students' critical thinking skills through inquiry-based learning model. *Journal of Physics: Conference Series*, *1317*, 012193. https://doi.org/10.1088/1742-6596/1317/1/012193

Ramsey, P. G. (2008). Children's responses to differences. *NHSA Dialog*, *11*(4), 225–237. https://doi.org/10.1080/15240750802432607

Reinhardt, S. (2015). *Teaching civics: A manual for secondary education teachers* (English ed.). Barbara Budrich.

Remmele, B., & Seeber, G. (2012). Integrative economic education to combine citizenship education and financial literacy. *Citizenship, Social and Economics Education*, *11*(3), 189–201. https://doi.org/10.2304/csee.2012.11.3.189

Safder, M., & Hussain, C. A. (2018). Relationship between moral atmosphere of school and moral development of secondary school students. *Bulletin of Education and Research*, *40*(3), 63–71.

Scanlon, E., Anastopoulou, S., Kerawalla, L., & Mulholland, P. (2011). How technology resources can be used to represent personal inquiry and support students' understanding of it across contexts: Technology resources and personal inquiry. *Journal of Computer Assisted Learning*, *27*(6), 516–529. https://doi.org/10.1111/j.1365-2729.2011.00414.x

Schank, C., & Hirata, J. (2024). Business ethics between orthodoxy and foundational critique: Thoughts on a taxonomy. In C. Fridrich, U. Hagedorn, R. Hedtke, P. Mittnik, & G. Tafner (Eds.), *Economy, society, and politics* (pp. 279–299). Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-42525-8_13

Schank, C., & Lorch, A. (2019). Sustainability citizenship through economics education: Contributions from the German debate on business ethics. *International Journal of Pluralism and Economics Education*, *10*(4), 401. https://doi.org/10.1504/IJPEE.2019.106125

Schmidt, C. (2015). Das Moralische im wirtschaftlichen Handeln – ein Thema für den Politikunterricht? In I. Juchler (Ed.), *Hermeneutische Politikdidaktik* (pp. 25–36). Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-05740-4_3

Setiyaningsih, L. B., Riandi, R., Amprasto, A., & Mardiyah, M. (2024). Application of the inquiry-based learning model with education for sustainable development to enhance critical thinking skills and sustainable awareness. *Jurnal Penelitian Pendidikan IPA*, *10*(10), 7790–7802. https://doi.org/10.29303/jppipa.v10i10.8943

Skinner, E. A., & Pitzer, J. R. (2012). Developmental dynamics of student engagement, coping, and everyday resilience. In S. L. Christenson, A. L. Reschly, & C. Wylie (Eds.), *Handbook of research on student engagement* (pp. 21–44). Springer US. https://doi.org/10.1007/978-1-4614-2018-7_2

Spencer, L. M., & Spencer, S. M. (1993). *Competence at work: Models for superior performance*. Wiley.

Spronken-Smith, R., & Walker, R. (2010). Can inquiry-based learning strengthen the links between teaching and disciplinary research? *Studies in Higher Education*, *35*(6), 723–740. https://doi.org/10.1080/03075070903315502

Steinmann, H., & Löhr, A. (1992). *Grundlagen der Unternehmensethik*. C.E. Poeschel.

Strat, T. T. S., Henriksen, E. K., & Jegstad, K. M. (2024). Inquiry-based science education in science teacher education: A systematic review. *Studies in Science Education*, *60*(2), 191–249. https://doi.org/10.1080/03057267.2023.2207148

Suchanek, A. (2007). *Ökonomische Ethik* (2nd ed.). utb GmbH. https://doi.org/10.36198/9783838521954

Syahid, A., Subaedah, S., Nurbaeti, N., & Arsyam, M. (2023). Meta-analysis of constructivist learning models in improving student learning outcomes. *Tafkir: Interdisciplinary Journal of Islamic Education*, *4*(4), 625–634. https://doi.org/10.31538/tijie.v4i4.718

Transparency International (Ed.). (2025). *Corruption perceptions index 2024*. Transparency International.

Ulrich, P. (1997). *Integrative Wirtschaftsethik: Grundlagen einer lebensdienlichen Ökonomie*. Haupt.

Ulrich, P. (2008). *Integrative economic ethics: Foundations of a civilized market economy*. Cambridge University Press.

Ulrich, P. (2012). Wirtschaftsethik als aktuelle Bildungsaufgabe. In G. Pfleiderer, G. Pfleiderer, & P. Seele (Eds.), *Wirtschaftsethik kontrovers: Positionen aus Theorie und Praxis* (pp. 153–158). Nomos Verlagsgesellschaft mbH & Co. KG.

Van Der Graaf, J., Segers, E., & De Jong, T. (2020). Fostering integration of informational texts and virtual labs during inquiry-based learning. *Contemporary Educational Psychology*, *62*, 101890. https://doi.org/10.1016/j.cedpsych.2020.101890

van Liedekerke, L., & Demuijnck, G. (2012). Europe. In D. Rossouw & C. Stückelberger (Eds.), *Global survey of business ethics in teaching, training, and research* (pp. 217–250). Globethics.net. https://doi.org/10.58863/20.500.12424/186303

Van Matre, J. C., De Wit, A., & Demeijer, F. (2025). Motivating business students for civic education: Design principles for aligning civic engagement programs with student motivation. *Journal of Business Ethics*. https://doi.org/10.1007/s10551-025-06059-w

van Riesen, S. A. N., Gijlers, H., Anjewierden, A. A., & De Jong, T. (2022). The influence of prior knowledge on the effectiveness of guided experiment design. *Interactive Learning Environments*, *30*(1), 17–33. https://doi.org/10.1080/10494820.2019.1631193

Veledar, B., & Bašić, M. (2021). A bibliometric overview of business ethics. *Journal of Forensic Accounting Profession*, *1*(1), 1–20.

Vogel, B., Spikol, D., Kurti, A., & Milrad, M. (2010). Integrating mobile, web, and sensory technologies to support inquiry-based science learning. *2010 6th IEEE International Conference on Wireless, Mobile, and Ubiquitous Technologies in Education* (pp. 65–

72). Institute of Electrical and Electronics Engineers. https://doi.org/10.1109/WMUTE.2010.41

Wang, F. H. (2017). An exploration of online behaviour engagement and achievement in flipped classroom supported by learning management system. *Computers & Education*, *114*, 79–91. https://doi.org/10.1016/j.compedu.2017.06.012

Wang, H.-H., Hong, Z.-R., She, H.-C., Smith, T. J., Fielding, J., & Lin, H. (2022). The role of structured inquiry, open inquiry, and epistemological beliefs in developing secondary students' scientific and mathematical literacies. *International Journal of STEM Education*, *9*(1), 14. https://doi.org/10.1186/s40594-022-00329-z

Wangler, N. (2019). Sozioökonomische Bildung als komplementärer Ansatz zur historischpolitischen Bildung in der Schule? In C. Fridrich, R. Hedtke, & G. Tafner (Eds.), *Historizität und Sozialität in der sozioökonomischen Bildung* (pp. 225–242). Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-22801-9_10

Wariyanti, A. (2019). Pengaruh model pembelajaran inkuiri terhadap kemampuan berpikir kritis dan hasil belajar siswa kelas iv sd pada subtema keindahan alam negeriku. *Jurnal Review Pendidikan Dasar: Jurnal Kajian Pendidikan Dan Hasil Penelitian*, *5*(2), 1019–1024. https://doi.org/10.26740/jrpd.v5n2.p1019-1024

Wehling, H.-G. (1977). Konsens à la Beutelsbach? Nachlese zu einem Expertengespräch. In S. Schiele & H. Schneider (Eds.), *Das Konsensproblem in der politischen Bildung* (pp. 173–184). Klett.

Weißeno, G., Detjen, J., Juchler, I., Massing, P., & Richter, D. (2010). *Konzepte der Politik – Ein Kompetenzmodell*. Bundeszentrale für politische Bildung . https://doi.org/10.25656/01:12009

Wieland, J. (1999). *Die Ethik der Governance*. Metropolis-Verlag.

Wong, S.-C. (2020). Competency definitions, development, and assessment: A brief review. *International Journal of Academic Research in Progressive Education and Development*, *9*(3), 95–114. https://doi.org/10.6007/IJARPED/v9-i3/8223

Yasa, A. D., Rahayu, S., Handayanto, S. K., & Ekawati, R. (2024). Evaluating the impact of smart learning-based inquiry on enhancing digital literacy and critical thinking skills. *Ingénierie Des Systèmes d Information*, *29*(1), 219–233. https://doi.org/10.18280/isi.290122

Zafra-Gómez, J. L., Román-Martínez, I., & Gómez-Miranda, M. E. (2015). Measuring the impact of inquiry-based learning on outcomes and student satisfaction. *Assessment & Evaluation in Higher Education*, *40*(8), 1050–1069. https://doi.org/10.1080/02602938.2014.963836

Zheng, L., Li, X., Tian, L., & Cui, P. (2018). The effectiveness of integrating mobile devices with inquiry-based learning on students' learning achievements: A meta-analysis. *International Journal of Mobile Learning and Organisation*, *12*(1), 77. https://doi.org/10.1504/IJMLO.2018.089238

2. Study 1: Responsible behaviour in the context of utility maximisation – An interview study on pupils' business ethics conceptions

Estler, V. & Brahm, T. (2025). Responsible behaviour in the context of utility maximisation – An interview study on pupils' business ethics conceptions. *Social Sciences & Humanities Open*, 11, 101386. https://doi.org/10.1016/j.ssaho.2025.101386[4]

[4] This study is a published version and therefore uses British English to remain consistent with the original. The remainder of this dissertation follows American English conventions for consistency.

Abstract

Ethical considerations are crucial in economic decision-making, however, how they develop has hardly been explored. Previous literature on conceptual research in the field of economic education has predominantly focused on purely economic topics, neglecting business ethics issues. To address this gap, 33 semi-structured interviews were conducted with pupils from secondary schools in Southwest Germany. Our study aimed to examine pupils' conceptions regarding ethical issues in economics. In this regard, we also investigated the level of business ethics the pupils' addressed (individual consumer, companies and governments) and the elaboration of their reasoning (elaborated, fragmented or no conception). The findings reveal that the pupils primarily emphasise personal consumption decisions, while political activities receive less attention. Moreover, the pupils perceive power and responsibility as contingent upon factors such as the number of individuals involved, company size, position within the company, social environment and age. Misconceptions regarding the roles of the state and companies in economic processes are also identified. The analysis of elaborateness and business ethical level reveals that the pupils predominantly respond in a fragmentary manner and at an individual ethical level. This research provides valuable insights into learners' ethical worldviews and suggests introducing business ethics content from the outset employing a collective perspective to prevent misconceptions regarding the business cycle.

Keywords: business ethics, phenomenography, pupils' conceptions, secondary school, economic education

Introduction

The pressing need to address environmental and social challenges, including biodiversity loss, climate change, and social inequities related to race, gender, social class and wealth distribution, underscores the importance of incorporating business ethics education in schools (Jaganjac et al., 2024; Montiel et al., 2020). A long-standing discussion calls for embedding business ethics in business schools curricula (Calder & Dautremont-Smith, 2009; Gandz & Hayes, 1988; Ghoshal, 2005). Meanwhile, it is crucial to recognise that addressing these pressing environmental and societal challenges is complex and uncertain (Montiel et al., 2020), particularly because corporations often encounter the conundrum that economic, environmental and social goals can only be reached through compromises (e.g., Hahn et al., 2010). Moreover, the rapidly changing world demands that corporations consider both short- and long-term ethical perspectives (Slawinski & Bansal, 2015).

These challenges require complex ethical decision-making competences (Loerwald & Schreiber, 2020). Accordingly, systemic educational processes are needed to foster these competences. However, pupils' understanding of ethical issues in business decisions remains unclear. While previous studies have investigated pupils' conceptions of purely economic phenomena (e.g., Speer & Seeber, 2012), research addressing ethical questions within economic education is lacking. This qualitative study aims to fill this gap by analysing interviews with 33 eighth-grade pupils from German secondary schools. We examined the level of elaboration in their conceptions (RQ1a) and the ethical level at which they argue (RQ1b) since ethical argumentation can address various ethical levels (i.e., individual, corporate or order level; Ulrich, 2008). In line with previous research, we also analysed both pupils' conceptions (RQ2a) and their misconceptions (RQ2b) (Brandts et al., 2019).

The present study represents – to our knowledge – the first empirical investigation of secondary school pupils' conceptions regarding business ethics. For pedagogical praxis, it offers key

insights into pupils' individual conceptions, which should be considered when designing effective learning environments to develop business ethics competences. Moreover, considering ethical questions within economic education highlights individual pupil perspectives, which have sometimes been neglected (Lutter, 2018).

Theoretical background

Business ethics in economic education

Ethical scandals have highlighted the need to integrate business ethics into higher education (e.g., Cowton & Cummins, 2003) and school system curricula (Heiduk, 2019). Research has shown that ethics education can impact business students' ethical attitudes, decisions and social responsibility awareness (Ariail et al., 2021; Hollier et al., 2013; Noel & Hathorn, 2014; Saunders et al., 2022). Since moral education fosters altruism in adolescence (Peters, 2015), assessing its role in secondary school economic education is crucial.

Notably, in many U.S. states and Germany, economic education in secondary schools is often integrated into other subjects or offered as an elective course (Kaiser et al., 2020). When economics is introduced into curricula, it is often discussed whether students may adopt the homo economicus paradigm (Hellmich, 2019). Some studies suggest that economics students exhibit less prosocial and more strategic behaviour (Bauman & Rose, 2011; Cipriani et al., 2009; Haucap & Just, 2010; Ifcher & Zarghamee, 2018). Even in moral decision-making contexts, they tend to prioritize rationality over personal values (Bauman & Rose, 2011; Haucap & Just, 2010). While these findings mainly pertain to economics students in higher education, their relevance for secondary school pupils remains unclear.

First, the concept of business ethics needs to be specified.[5] In the American context, it is defined as "the moral principles and standards that guide behaviour in the world of business" (Ferrell & Fraedrich, 1991, p. 5). While American business ethics is often application-oriented (Palazzo & Palazzo, 2011), German business ethics emphasises reflection and theory (Palazzo, 2002). Barth and Michelsen (2013) stress the importance of critically examining economic norms and values for sustainable development. Therefore, and given the German educational context in which the study took place, the following elaboration will focus on the German business ethics discourse.

Two central German theories in this discourse are order ethics, as proposed by Karl Homann, and discourse ethics, primarily represented by Peter Ulrich. These approaches differ fundamentally in their goals and understanding of the individual's role, which is crucial in socioeconomic education (Schank & Lorch, 2019).

In German business ethics, several approaches complement these two dominant schools of thought. These include Wieland's governance ethics emphasising a normative theory of economic virtues and value-oriented management within enterprises (Rendtorff, 2017; Wieland, 2014). The ethics of responsibility from Jonas (1979), expanded by Lenk and Maring (1992), integrates corporate ethics into individual and collective responsibilities (Maring, 2014). Küng's (1990, 2010) global business ethics draws on shared religious principles, further developed by Dierksmeier and Pirson (2010) into a theory of relational freedom fostering dignity and freedom in leadership (Rendtorff, 2017). Additionally, Steinmann (2008) contributes republican and discourse ethics, advocating for ethical norms in international corporate citizenship, which closely aligns with Peter Ulrich's discourse ethics (Rendtorff, 2017). Since most of these approaches emphasise corporate ethics, this study will concentrate

[5] In relation to this field of research, the terms "business ethics" and "economic ethics" are variously used. Since the former is more common, it will be used henceforth in this work. In the American context, this term is sometimes applied only in relation to companies and organisations. However, we use the term in a holistic manner and apply it to the entire economic system.

on the more holistic approaches of Ulrich (2008) and Homann (1999), as they are more applicable to its context.

Homann (1999) integrates ethics into economic models, arguing that institutional guidelines, codified as legal regulations, provide the strongest incentives for fostering ethically desirable behaviour (Homann & Blome-Drees, 1992). They significantly shape individuals' economic and non-economic decisions. This approach positions the design of institutional frameworks as central to ethical considerations, with the free market principle promoting solidarity and welfare through competition. Homann identifies a conflict between market and morals: individual moral actions can harm societal well-being. He terms this conflict a dilemma in his theory of order ethics (Homann & Suchanek, 2005), shifting moral responsibility from individuals to regulatory institutions.

In comparison, Ulrich's discourse-ethical approach emphasises dialogue to explore the relationship between economy and society (Schank & Lorch, 2019). Ulrich's approach involves three tasks: (1) critiquing economism (i.e., reflecting on economic rationality); (2) redefining economic rationality through ethical considerations to develop a discourse-theoretical concept; and (3) determining the "sites of systematic mediation between moral claims and the functional conditions of the economic system" (Ulrich, 2008, p. 269), meaning the locations where morality is to be interwoven into economic thinking and action (Ulrich, 2008).

Ulrich (2008) argues that economic systems should serve life rather than being ends in themselves (Küpper, 2007), placing ethics above efficiency in decision-making. The basis for decisions should be a discourse that considers the criterion of reasonableness, since in modern societies, morality finds its expression in public discourse. Thus, in contrast to Homann's approach, Ulrich sees ethics as dominating the economy (Ulrich, 2008), and views individuals as morally responsible citizens, not just rational actors maximising self-interest (Schank & Lorch, 2019). Ulrich (2005) further advocates for developing reflective competence in ethical,

political, and economic matters, to ensure that public reason is integrated into both politics and economics (Schank & Lorch, 2019; Ulrich, 2008).

Furthermore, Ulrich (2008) emphasises the relationship between individual ethics and institutional ethics, where individual ethics relate to personal responsibility, and institutional ethics to regulatory guidance. The connection between individuals' moral expectations and legal regulations is crucial, as a morally grounded economic and social order fosters responsible citizens who shape economic activities within ethical institutions (Ulrich, 2008). Ulrich identifies three levels of ethics: economic citizen's ethics, regulatory ethics, and corporate ethics (Ulrich, 2008, p. 271). Executives should ensure companies contribute beyond profit, while corporations must support market legitimacy (Ulrich, 2008). Overall, Ulrich's integrative economic ethics advocates limiting profit maximisation in favour of ethical priorities.

In the German educational context, specifically in Baden-Württemberg, economic education in Grades 8–10 follows a tripartite structure (consumer, employee and economic citizen) (Ministry of education, youth and sports Baden-Württemberg, 2016; Seeber et al., 2012), which aligns with Ulrich's (2008) ethical levels. Therefore, this manuscript will refer to these three sites of morality. Distinguishing different ethical levels allows pupils to understand social dilemmas, as explained by Homann and Suchanek (2005), and to develop solutions (Loerwald, 2020). Therefore, both approaches are central to this study.

Previous research on pupil conceptions of economic phenomena and business ethics

In cognitive psychology, conceptions are mental representations that "are constructed over time within our mind/brains, and they can be reformed, refashioned, reconstructed, transformed, combined, altered and undermined" (Gardner, 2006, p. 46). While relatively stable like personality traits, they remain modifiable (Chi, 2005; Duit & Treagust, 2003; Gardner, 2006). These cognitive representations correspond to hypothetical internal knowledge structures, encompassing objects, events, or even non-existent phenomena, formed through individual

experiences. Mental representations form mental models, ranging from basic terms to comprehensive concepts (Gardner, 2006; Sternberg, 2011).

Conceptions are often evaluated against scientific standards (e.g., Goel et al., 1996; Hmelo et al., 2000), with the elaborateness of pupils' conceptions being a key focus (Aprea, 2015). In this context, more advanced conceptions involve greater dimensionality or recognition of additional aspects (Herbert & Pierce, 2013). Therefore, scope, precision, and interconnectedness are critical (Aprea, 2015). Consequently, distinguishing between the terms "misconception" and "error" is important, as pupils' reasoning may follow its own internal logic (Davies, 2023).

Previous studies on pupils' conceptions in economic education have predominantly focused on economic issues. Several studies have addressed general economic topics, including pupils' perceptions regarding economics education and the economy in general (Szoncsitz, 2020), regional economics (Friebel et al., 2013), the economic and financial crisis of 2008 (Aprea, 2015; Aprea & Sappa, 2014; Klee & Lutter, 2010; Lange & Haarmann, 2011), and the labour market (Böhmer & Cebulla, 2011; Kölzer, 2014). Specific topics include goods and services (Davies & Lundholm, 2012), electricity trading (Friebel et al., 2016), supply and demand (Pang & Marton, 2005; Pang & Meyer, 2010), wage and price formation (Birke & Seeber, 2012), rent ceilings (Brandts et al., 2019), value-added tax (Pang & Marton, 2003), money (Kahler, 2011) and loans (Speer & Seeber, 2012).

Relatively few studies address pupils' conceptions of business ethics. Siegal and Shwalb (1985) found adolescents prioritize financial support for those in need, except in cases of low effort despite high ability. Bloemen (2009) highlighted that pupils emphasised ecological sustainability over other dimensions of sustainability. Ignell et al. (2013) found Swedish pupils had a limited awareness of the environmental effects on pricing and market mechanisms. A

follow-up study by Ignell et al. (2017) revealed varied perceptions, ranging from basic ideas about production costs to more complex considerations of resource impacts.

In comparison, Lemme and Neuhof (2014) found that pupils' conceptions of the state are stimulus-dependent rather than fundamental. Focusing on secondary school pupils' conceptions regarding global inequality, Kleinschmidt et al. (2015) noted that pupils focused on colonial structures of superiority and inferiority but overlooked power and exploitation. Additionally, Lange (2012) observed that ninth graders' conceptions of social order and inequality reflect patterns akin to scientific theories. Lenk (2011) also investigated pupils' conceptions of social justice, discovering a strong connection between their conceptions and their everyday life experiences. Furthermore, Kaiser et al. (2015) found that pupils judged social market economy issues from a single, unreflected perspective. Moreover, Ekström and Lundholm (2021) highlighted conflicting pupil notions on values and impartiality, reflecting varying epistemic beliefs.

In summary, while some studies focus on economic concepts, little research has investigated pupils' conceptions related to business ethics. To our knowledge, no study has comprehensively examined pupils' conceptions regarding business ethics yet. Although one study investigated the elaborateness of pupils' conceptions (Aprea, 2015), this approach needs to be transferred to business ethics. Therefore, this study addresses these research gaps based on the following research questions:

RQ1: How elaborate are the conceptions of eighth-grade pupils regarding ethical issues in economics (RQ1a), and on which ethical level do they argue? (RQ1b)

RQ2: What conceptions (RQ2a) and misconceptions (RQ2b) do eighth-grade pupils have related to ethical aspects in economics?

Method

A phenomenographic approach was used to address the research questions, focusing on the diversity of conceptions and experiences of a phenomenon (Marton, 1981). Phenomenography examines variations of human meanings, understandings, conceptions, and experiences (Marton, 1981; Marton & Booth, 1997). According to Åkerlind (2005), each individual sees the world differently. Phenomenography can also serve to determine crucially different factors among a group of people involved in a common situation (Marton, 1981). Results are presented as "categories of description" (Åkerlind, 2005, p. 322), reflecting qualitatively different ways of experiencing the phenomenon, structured hierarchically as the "outcome space" (p. 322).

To ensure precision, Marton and Booth (1997) emphasise three quality criteria:

(1) each descriptive category should open up something different,

(2) the categories should be logically connected,

(3) understanding variations should involve the fewest possible number of categories.

Notably, phenomenographic research does not attempt to explore the range of understandings of each individual in a group. Rather, it aims to capture a range of meanings within a sample group. Consequently, the interview transcripts are interpreted in the group context (Åkerlind, 2005).

Sample

The sample includes 33 eighth-grade pupils from 17 classes across seven public secondary schools in Southwest Germany, where economics is integrated into the curriculum (German Education Server, 2023). The eighth grade was deliberately chosen for better comparability, as pupils had half a year of economics coursework but no prior exposure. This reduced potential bias in the results due to pupils having different teachers in previous years. Generally, the adolescents were 13–14 years old. An equal gender distribution was ensured by interviewing one boy and one girl from each class, with one exception. The pupils in each class were

randomly selected by instructing the teacher to always choose Nos. 7 and 16 from the class list. If these two pupils were of the same gender, the teacher was instructed to choose No. 15 or 17.

Data collection

Semi-structured interviews are the dominant method for phenomenographic research (Åkerlind, 2005), offering pupils flexibility to express their personal ideas and experiences while avoiding over-structuring. It also allows for direct dialogue and term clarification, without placing excessive demands on pupils. A completely open approach might require skills in content or articulation that secondary school pupils do not possess (Aprea, 2015). Therefore, the semi-structured interview method was chosen.

The interviews lasted 15–35 minutes and were conducted during regular class hours in a separate classroom. The interviews took place in June and July 2023. Prior to this, two pilot interviews, excluded from analysis, tested the interview questions. In line with Åkerlind (2005), both open-ended and situational questions were asked to understand what business ethics meant to the pupils and to obtain specific examples of their conceptions. The interview guide covered four key categories:

(1) consumption and abstinence,

(2) economic circulation,

(3) market forms,

(4) power relations.

These content areas were based on the eighth-grade curriculum (Ministry of education, youth and sports Baden-Württemberg, 2016). The questions specifically focused on consumer responsibility, companies, and the state's role in shaping economic conditions, thus encompassing the three levels of integrative economic ethics (Ulrich, 2008). Structuring the interview questions along these three levels enables a comprehensive analysis and establishes a close connection to the theory. Regarding the concept of responsibility, we adhere to Negru

and Dolfsma's (2022) definition: "Responsibility in an economic context means acting towards the good of the other as well as the collective good. Others may be individuals and institutions including society" (Negru & Dolfsma, 2022, p. 903).

Therefore, each content area included one question on these three levels, a general question on responsibility, and a case study from a textbook used in the local federal state. In total, apart from follow-up questions, 23 questions were asked (see supplementary material for the complete interview guideline). Through the case studies and overarching questions, 11, 7 and 5 questions were posed at the order, corporate and individual ethics levels, respectively.

Data analysis

After data collection, the interview recordings were transcribed verbatim and fully anonymised. For data analysis, the MAXQDA 24 software was used. To identify the level of elaboration (RQ1a) and the level of business ethics (RQ1b), all pupil statements were analysed using an assessment grid that had previously proven useful in studying the economic and financial crisis of 2008 (Aprea, 2015). Table 2 illustrates the adapted grid.

Table 2

Analysis of elaboration

Elaboration	Definition	Example
Elaborated conception	The pupil evaluates based on business ethical categories, consistently uses economic terminology.	*"So, I think it's more about the companies that are here in Germany because they produce and sell those products, so they should also pay attention to how their products are actually manufactured. They shouldn't just blame the countries that produce them, but they are actually responsible for their product and how it's made."*
Fragmented conception	The pupil demonstrates initial attempts at evaluation using business ethical categories, occasionally uses economic terminology.	*"The government might have a say in what we consume. So that's what it means, and I don't see that I want to be restricted by the government in such matters."*
No conception	The pupil has no understanding of business ethical categories, does not use economic terminology, or uses them incorrectly or unrelated to the question.	*"But on the contrary, I don't think that's correct, that the government controls anything there."*

Note. Adapted from Aprea (2015). Examples are translated from German into English by the first author.

After identifying an anchor example for each category and reviewing the assessment grid with the two researchers, the pupil statements were assigned to the framework levels. Statements were coded as an "elaborated conception" if the pupil consistently used economic terminology and performed evaluations according to business ethical categories. However, if a pupil only sporadically used economic terminology and could only perform evaluation in a rudimentary manner according to business ethical categories, the statement was classified as "fragmented". A response was categorised as exhibiting "no conceptions" if the statement contained no economic terminology, terminology was used incorrectly or it was unrelated to the respective question; consequently, it was not evaluated according to business ethical categories.

In the next step, a similar approach was chosen to analyse the business ethical level (RQ1b), based on Ulrich's (2008) three-level model: individual ethics, corporate ethics, and order ethics (see Chapter 2.1). Accordingly, an adapted assessment grid was devised (Table 3). At the order ethical level, statements addressing structural and institutional facets within the economic system were classified, while those pertaining to corporate entities and organisations were assigned to the corporate ethical level. First-person statements focused on the individual were assigned to the individual ethical level. As described earlier, more questions were asked at the order ethics level than at the other two levels. Assuming that pupils tended to respond at the level at which the question was aimed, the coded segments were converted using an imputation matrix to ensure that, on average, each level was addressed with equal frequency.

Table 3

Analysis of the level of business ethics

Level	Definition	Example
Order Ethics	Structural and institutional aspects, naming the state, state institutions, global issues (macro-level)	*"But, on the contrary, I don't believe it's right that the government controls or influences us in that way."*
Corporate Ethics	Naming of customers/ consumers, companies, and organizations (meso-level)	*"There are many companies in Germany that have an impact on this, and I believe they have to take responsibility for it."*
Individual Ethics	Focus on the individual, description in first-person (micro-level)	*"As an individual person, I probably can't do it as effectively."*

Note. Adapted from Ulrich (2008). Examples are translated from German into English by the first author.

For the analyses, a total of 2,326 statements were coded. The results of both types of analysis were validated by another researcher who was not involved in conducting the study. This

researcher also coded all transcripts. The inter-rater reliability coefficients with respect to phenomenography, the analysis of elaboration, and the analysis of the business ethics level were 0.85, 0.82 and 0.83, respectively. This indicates a good level of inter-rater reliability.

Following the classification of the elaboration and the business ethics level, the pupils' different conceptions regarding (a) what gives a consumer power or responsibility, (b) what this depends on, and (c) which misconceptions prevail were identified. The following steps were then executed in accordance with pertinent recommendations from the phenomenographic literature (e.g., Åkerlind, 2005).

First, all transcripts were read multiple times, and statements were summarised into a decontextualised "pool of meanings" (Åkerlind, 2005, p. 327). Relevant statements were identified, categorized, and refined through discussions among researchers. Preliminary description categories were designed and repeatedly reviewed by three researchers (the two co-authors and a fellow researcher). In this early phase of analysis, the focus was more on meaning than on the structural relationship between categories (Ashworth & Lucas, 2000). The researchers were vigilant not to include data that might not be directly assignable to the created categories (Åkerlind, 2005). In a subsequent step, differences within the categories were identified and hierarchically arranged. In line with Kvale (1996), the categories were reassessed and validated by the three researchers through a communicative process. Subsequently, the pupils' individual statements in the interviews were reassigned to the categories. Overall, the description categories and their structural characteristics correspond to the so-called "outcome space" (Marton & Pong, 2005, p. 335).

Results

Analysis of elaboration and level of business ethics (RQ1)

Elaboration (RQ1a)

In the pupil statements, "elaborated conceptions" were coded 263 times and appeared most frequently at the order and individual ethics levels. "Fragmentary conceptions" were comparatively more common, with 624 coded segments. They were particularly frequent at the order ethics level, while connections at the individual and corporate ethics levels appeared with similar frequency. In comparison, "no conceptions" was coded 197 times, making it the least frequent category.

Thus, the number of fragmented conceptions is remarkably high. This picture becomes even clearer when looking at the means for average frequency per interview. Exact values are presented in Table 4.

Table 4

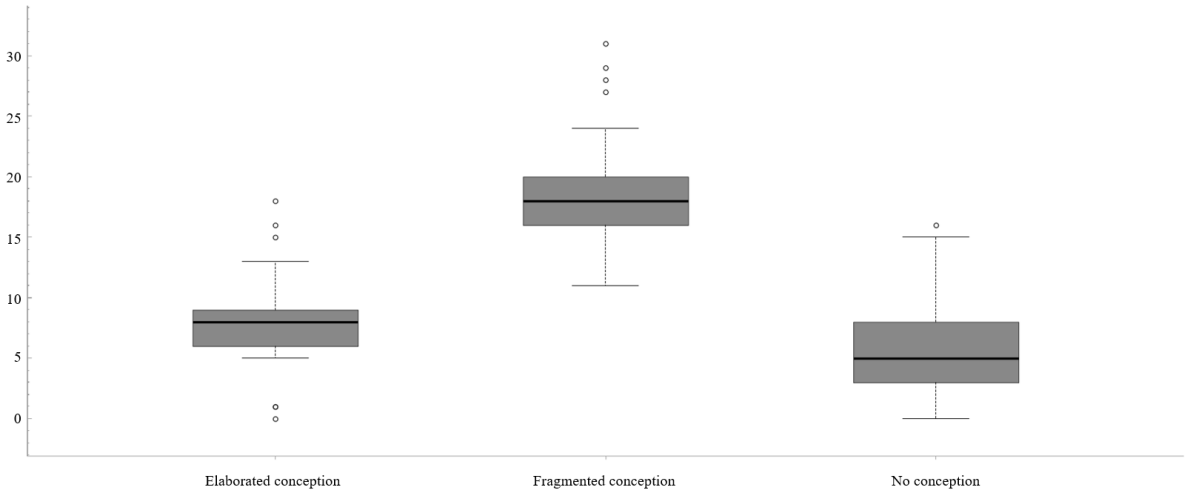
Frequency of the elaboration

	Encoded segments	% of encoded segments
Elaborated conception	263	24.26
Fragmented conception	624	57.56
No conception	197	18.17

In terms of distribution per interview, 1–18 elaborated statements were coded, 11–31 fragmented conceptions were determined, and 1–16 statements did not contain any conception. The precise distribution is illustrated in Figure 6.

Figure 6

Distribution of the elaboration



Note. Figure 6 illustrates the distribution of student responses coded as elaborate per interview.

Business ethics level (RQ1b)

The analysis of the business ethical levels yielded an excess of responses at the order ethics level. This is because the interview guidelines contained more questions at the order ethics level than at the other two levels, and more questions were asked about the corporate ethics level than the individual ethics level (Chapter 3.2). When this factor is considered, the situation is reversed. Using the imputation matrix, individual, corporate, and order ethical statements account for approximately 425, 282 and 288 coded segments, respectively. Thus, pupils predominantly responded at the individual ethics level. The exact values are presented in Table 5.

Table 5

Frequency of the levels of business ethics

	Customized encoded segments	% of encoded segments
Order Ethics	288	28.94
Corporate Ethics	282	28.34
Individual Ethics	425	42.71

At the corporate ethical level, elaborated responses were slightly more frequent than those with no conceptions. Regarding the relationships between this elaboration and ethical segments, the same pattern favouring individual ethical segments is evident.

Percentage-wise, order ethics and corporate ethics responses were more evenly distributed across multiple interviews, each constituting a maximum of only 14% and 22%, respectively, of the coded statements per interview. Statements related to individual ethics are more concentrated in fewer documents, with a maximum proportion of up to 39% per interview.

Analysis of prevailing conceptions regarding business ethics (RQ2a)

Consumers' power and responsibility

This section explores the categories that emerged from the data, focusing on how a consumer has power or responsibility in different spheres of their economic life (the pupil quotes were translated from German by the first author). Table 6 summarizes the identified categories and corresponding subcategories.

Table 6

Consumers' power and responsibility

What gives the consumer power / responsibility?	Categories
Consumption decisions	Buy organic products
	Buy sustainable products
	Buy products that were produced under good working conditions
	Conserve resources / be mindful of actions
	Be mindful of the environment / avoid buying much plastic
	Buy Fairtrade products / find out where the products come from
	Pay attention to labels / seals
	Don't buy cheap products
	Buy local products
	Only buy products that are needed
	Don't buy a new phone so often
	Buy healthy products
	Buy less / no meat
	Don't buy from major brands
	Consider if that's possible / check what you're buying
Political activity	Demonstrate / protest
	Strike
	Petition
	Motivate / inform other people
	Go vote
	Complain
As part of the company	Own work
	Position
Origin	Nationality
	Wealth / financial opportunities

Note. Categories are translated from German into English by the first author.

Consumer decisions

The pupils' conceptions regarding consumer decision-making are very distinct from the other categories. While many responses were directed towards this topic, they were also highly diverse, capturing a wide range of characteristics within this category. By far, the most frequently mentioned approach to taking responsibility for one's own consumption was purchasing fair trade products or informing oneself about product origins: "Well, I could just make sure that I buy products that have been produced fairly, where people have received enough money for them" (School1_P1_F, pos. 17).

Additionally, the pupils often referred to the purchase of sustainable products as a way to exercise responsibility in their consumption: "So, I think you can take over a lot of responsibility. Maybe just make sure that you buy things sustainably" (School1_P2_F, pos. 17). The purchase of organic and regional products was also mentioned (School4_P4_F, pos. 15; School2_P1_M, pos. 13).

Furthermore, some pupils held the viewpoint "that you should just pay attention to the label and then […] just buy it" (School3_P1_F, pos. 11). Avoiding buying cheap products was also mentioned: "[A]nd don't always go for the cheapest; just make sure it's good and not cheap" (School1_P3_F, pos. 13).

Other pupils held the opinion that one should consider whether the price is justifiable and carefully examine purchases. Being environmentally conscious and avoiding buying a lot of plastic were also possibilities mentioned. As one pupil highlighted, "We don't use a lot of plastic, so we don't buy a lot of plastic. We pay a lot of attention to the environment" (School1_P4_F, pos. 12).

Two pupils also named conserving resources, emphasising the need to be aware of one's actions: "By simply saving on things you don't need or something. By simply turning down the heating when you don't need it. By simply turning off the lights when you have sunlight outside,

or something like that" (School4_P1_M, pos. 19). Additionally, pupils noted that one should only buy necessary products. For instance, one pupil recommended not buying a new phone too often: "For example, the biggest example is simply not to buy a new mobile phone that often" (School3_P2_M, pos. 11). Avoiding shopping for big-name brands was also mentioned.

Furthermore, pupils recommended taking responsibility by purchasing little or no meat: "[F]or example, eat less meat […] so perhaps less meat will be produced and fewer animals will be killed" (School5_P1_F, pos. 5). Only one pupil advocated buying healthy products.

Political activity

In the analysis of the data material regarding how a consumer has power or responsibility, the pupils suggested various ways in which political engagement can be used to exert influence. This category also comprises a relatively large number of subcategories.

The option to participate in demonstrations or protests was regularly mentioned: "Because you can also boycott certain things or protest, demonstrate. You know, go out on the street" (School3_P3_F, pos. 55). Furthermore, one pupil explicitly noted staging strikes as a means of influence but, in the same statement, acknowledged that this yields minimal results in terms of change: "Like a strike or something usually doesn't change anything" (School3_P2_M, pos. 39).

Moreover, several pupils mentioned that "you can complain or something, and then maybe something will be changed" (School2_P1_M, pos. 53). References to complaining pertained to various contexts. The pupils suggested complaining to the government, one's parents, and especially to companies or one's own boss. Capturing others' attention and motivating them were also mentioned as strategies for taking responsibility or exerting influence:

> But I think everyone should try to motivate other people as well because I think it's much more effective than just trying to do it right for yourself. I also think you should use the

> internet, for example, to try and motivate people to do the same thing or better than they're doing it now (School1_P4_F, pos. 26).

Additionally, voting and organising petitions were suggested by one pupil each: "So, you have the power, but also over the state, because you vote for it" (School1_P5_M, pos. 51).

Individuals as part of the company

Regarding how consumers have power or responsibility, many pupils referred to one's role in a company and stated that one's work is markedly connected to one's power or responsibility:

> Yes, I'd say that you're responsible for that yourself. … And you're responsible for preparing yourself somehow so that you can get a job that you'd like, and that you maybe make an effort or write an application or something (School2_P1_M, pos. 57).

However, this power or responsibility is dependent not only on one's work but also on one's position within a company: "Yes, you can probably earn the power. So, through higher positions in your job or something like that. So, you're also responsible for that yourself" (School1_P6_M, pos. 79).

An individual's place of origin and upbringing, including their nationality or financial standing, were mentioned the least frequently in connection with having power or responsibility overall. Generally, nationality was addressed in this context through a comparison between Germany and other countries: "I think I have, and even when you look at other countries, comparatively, a lot of power" (School1_P8_M, pos. 61). Financial background was also mentioned: "So, I think one has a lot of power as a consumer because you can really make decisions if you can afford it" (School5_P1_F, pos. 75).

Synthesis

In general, the question regarding how consumers exert power or responsibility revealed the pupils' predominant focus on their own and others' consumption decisions. They strongly

emphasised fair trade and product origins. Political activities were mentioned relatively less frequently and seemed to be less deeply rooted in their minds. Furthermore, personal effort was identified as a central influencing factor. The pupils often described the need to strive in school and "in education" to secure a good profession or avoid unfavourable working conditions, as this ultimately determines one's position within a company, leading to varying degrees of power and responsibility. Pupils' financial or nationality-related backgrounds played a comparatively minor role and were less frequently mentioned.

Determinants of consumers' power or responsibility

In response to the question regarding what the power or responsibility of a consumer depends on, the pupils provided various explanations, which will be examined further in this section.

The **distinction between an individual and a large group** was mentioned by far the most frequently. Many pupils believed that they had little influence as individuals in terms of power or responsibility. For them, a large group, in comparison, has a great deal of power or responsibility. One pupil stated, "So, as an individual, you cannot influence that much. But the crowd as a whole can have a very, very big influence" (School1_P7_M, pos. 5).

A similar pattern emerged regarding **participation in the economic system**: many pupils argued that increased involvement in the economy leads to a greater impact.

Furthermore, **the type and size of companies** were mentioned as factors influencing the power and/or responsibility of a consumer: "So, it depends on how big the company is. If it's a small lemonade stand, then maybe my own consumption could make a difference. But, if it's such a big company, I don't think my individual consumption could change anything" (School5_P2_M, pos. 7).

As another factor pertaining to people's interactions with companies, pupils mentioned **one's position within a company**. Most agreed that each individual is personally responsible for their profession. Additionally, as one pupil said, "So, if you work in a smaller company, for example,

you have more responsibility if you can influence things a bit and can also say if you don't like something" (School3_P2_M, pos. 39). Moreover, holding a higher position (e.g., of a "boss") was considered to carry greater responsibility and more power.

Additionally, **age and the pupil's role** were identified as influencing factors. In particular, a pupil's role was strongly associated with limited participation in the economic system: "I am still a pupil, and I go to school. I rarely go shopping" (School6_P1_M, pos. 117). Regarding age, pupils expressed the belief that older people may not be able to inform themselves about products or manufacturers through the internet. However, not yet being of age was also cited as a reason for having less power. In terms of responsibility, older individuals were considered to have more responsibility, while younger individuals or pupils were seen as having little.

This rationale is closely related to another factor noted by the pupils: the **role of parents or the social environment**. From this perspective, it is the duty of parents to take on the responsibility of managing their children's finances. Generally, it was understood that parents bear a greater responsibility in this regard: "So, a lot of [responsibility lies with] my parents" (School4_P2_M, pos. 21). Additionally, the consumer's responsibility is influenced by the social environment, with the observation of others' behaviour playing a significant role: "And one lives, for example, in a family or something, and they do notice how one behaves and what things one buys and such. And in society, I think it's often the case that when one person does it, several others do it as well" (School2_P1_M, pos. 7).

Furthermore, place of residence influences the consumer's power and responsibility. For instance, one pupil argued that individuals should not move to a neighbourhood where finding work is challenging since one bears the responsibility for their employment. Another pupil mentioned health as an additional justification. According to this perspective, mentally impaired individuals are not obligated to seek employment. The same applies to individuals with children in the household, as they might be unable to work due to their caregiving

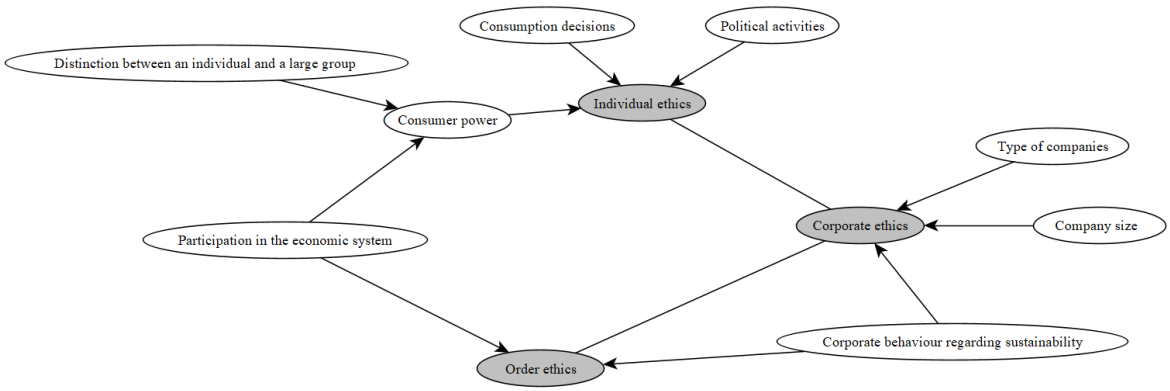
responsibilities: “But some people can’t work, simply because of their mental state or because of the children at home. But you should actually always have a job” (School4_P3_F, pos. 65).

Overall, pupils viewed large groups as having significantly more power and responsibility than individuals. The same reasoning is evident regarding participation in the economic system. Similarly, the justification that one’s responsibility and power depend on the size of the company is aligned with this mindset. Furthermore, one’s position within the company, as well as one’s social environment or parental home, are factors that exert influence. Age was widely seen as a determinant of power, with pupils perceiving their own role as granting them little power or responsibility. Less-frequently mentioned factors were place of residence, illness or children in the household as reasons for limits on one’s power or responsibility.

Figure 7 shows the interconnection between Ulrich’s three levels and our results. From the pupils’ perspective, individual ethics primarily consist of consumption decisions and political activities. Their power is perceived as a collective effort, mainly through participation in the economic system. Companies are predominantly distinguished by their size and type, with sustainable behaviour appearing to be particularly relevant to pupils. While order ethics is not directly addressed, it is nonetheless implicitly apparent in the pupils’ responses.

Figure 7

Framework for ethical reasoning in economic contexts from student perspectives



Note. Figure 7 illustrates an overarching framework of the key findings regarding students' conceptions and how they are interconnected.

Misconceptions (RQ2b)

In the data material, some misconceptions of pupils regarding business ethics issues became apparent, which are now further elaborated upon.

Several pupils stated that the government raises and lowers wages, thus explicitly determining them: "Well, anyway, the state also pays wages to households, and so to us" (School1_P1_F, pos. 71). This notion may indeed be correct when a person is employed by the state, but in the classic economic cycle, the population works for companies and is also paid by them.

Moreover, from the pupils' point of view, the state is entrusted not only with the disbursement of wages but also with the setting of specific prices: "But I'd say not necessarily. For example, it's the state that sets them [the prices]" (School6_P2_F, pos. 87). This individual evidently believed that the government sets certain prices (and not companies).

Furthermore, the power dynamics within the business cycle seemed to be unclear to the pupils:

> Actually, the boss also has a say in it and probably meets with his colleagues or something to discuss it, and then they also hold a conference. With the state, for example, so that it

> agrees that they have only so much power, not that they end up with more power than the state (School7_P1_F, pos. 61).

The following statement also indicates a misunderstanding of the business cycle: “Well, it’s their own responsibility. They [the companies] can decide how they want it – whether they want competition or not” (School1_P6_M, pos. 61). Here, the concept of competition appears to be incorrectly anchored.

Another misconception was found regarding sustainability or sustainable products: “So, sustainable products are something like [...] some things that are vegan or something” (School7_P1_F, pos. 11). The pupil seemed to equate sustainable products with vegan products and could not distinguish between the two terms.

In general, it became apparent that the responsibilities of the state and companies were partially misconstrued by the pupils, who thought that the setting of prices and payment of wages are the responsibilities of the state and not of companies. Furthermore, there were misconceptions about power distribution and competition within the business cycle.

Discussion

The findings of this study indicate that secondary school pupils predominantly respond in a fragmented manner and at an individual ethical level when reflecting on business ethics questions. Notably, more pupil responses were coded as “elaborated conceptions” than “no conceptions”, although the pupils had only one semester of economics education. This contradicts the findings of Aprea (2015), who found more instances of no conceptions in her study concerning the financial and economic crisis of 2008. This might be due to the prevalent consumer perspective of the questions which is potentially closer to the pupils’ daily lives than the financial and economic crisis.

Against the backdrop of Ulrich's (2008) integrative business ethics, which is embedded in the school curriculum through its three levels, such an assumption appears reasonable. During their first year of economics education, pupils primarily focus on the individual level of business ethics. Consequently, as Aprea (2015) also found, the pupils demonstrate less knowledge of other levels of business ethics.

Most responses about consumers' power and responsibility focused on consumption decisions, which is consistent with prior research (Friebel et al., 2013). Political activities are mentioned relatively less frequently. This also confirms the previously stated hypothesis as political activities often fall under the realm of order ethics rather than individual ethics, and therefore are emphasised less in the classroom which could be the reasons why they are mentioned less often. Nevertheless, pupils also identified personal engagement as a factor that can influence power and responsibility. Regarding the question about what a consumer's power and responsibility depend on, the pupils mostly agreed that a large group possesses significantly more power and responsibility than an individual. This argument extends to participation in the economic system. According to the pupils, the extent of one's power or responsibility also depends on the size of the company for which one works and one's position within it. Additionally, the social environment, especially the family, was mentioned as an influencing factor. Moreover, age and their role as pupils were considered determinants of their individual power and responsibility.

Several misconceptions also became apparent. For instance, the responsibilities of the state and companies were sometimes incorrectly attributed. Pupils often viewed price setting and wage payment as state responsibilities rather than corporate ones. This result aligns with previous research finding that pupils lack a fundamental understanding of the state (Lemme & Neuhof, 2014). Our study corroborates this by identifying misconceptions regarding order ethical issues, the predominance of individual-level ethical arguments and numerous fragmented conceptions.

Misunderstandings about power distribution and competition within the business cycle were also prevalent, supporting our hypothesis about the differences in knowledge across the various levels of business ethics.

Our study results also differed from the previous literature. As mentioned above, many pupils in our sample acknowledged that the power and responsibility of a company depends on its size. For instance, pupils reported avoiding purchases from large brands. They also noted that large companies wield significant power and often outcompete or acquire smaller businesses. This notion surprisingly demonstrates a strongly negative view of large companies. This negative perception of companies could again stem from a more limited knowledge of corporate ethics. In contrast, Kleinschmidt et al. (2015) found that pupils did not recognise power and exploitation structures.

Our results also show that the pupils were aware of impacts on other market participants, contradicting the findings of Kaiser et al. (2015). These differences might be related to the recent integration of economic education into the secondary school curriculum in Southwest Germany. Lessons in economics might be a contributing factor so that pupils gain a more comprehensive understanding of market activities. Moreover, while Kaiser et al. (2015) concluded that pupils typically make unidimensional judgments, our findings suggest that they often adopt a multi-perspective approach. This indicates that pupils are capable of developing multidimensional perspectives on consumer decisions, reflecting a nuanced understanding of responsibility. For example, in the context of consumption decisions, pupils referred to resource conservation and, in the political context, to motivating others or organising a petition. Regarding resource conservation, our results support the findings of Davies and Lundholm (2012), who reported that pupils believed certain products and services should be offered free of charge, depending on available resources.

Surprisingly, only one pupil mentioned staging strikes despite its prevalence in the media and everyday life. Aprea and Sappa (2014) observed that pupils use their everyday experiences to fill potential gaps in their understanding of a topic and noted a lack of connection between individual situations and the collective context in pupils' perceptions. In comparison, some categories in our study (e.g., not purchasing cheap products) suggest that pupils can make this connection. Accordingly, the majority of pupils in our sample emphasised the importance of local products and avoiding plastic despite higher costs, indicating an awareness of environmental impacts. This, however, contrasts with the results of Ignell et al. (2013), who reported that most pupils do not link environmental impacts and prices. This deviation from previous studies might also be the result of recent societal developments. In comparison to the early 2010s, young people and society in general have recently become more aware of the environmental impact of human (economic) behaviour.

Finally, we found it surprising that an individual's financial background was rarely mentioned as influencing power and responsibility. Nevertheless, many pupils recognised that extensive participation in the economic system increases power and responsibility. Instead of their individual backgrounds, pupils indicated that power and responsibility depend on factors such as illness, implying that ill people have less influence than healthy people. Other influencing factors mentioned were place of residence or having children in the household. The former is particularly intriguing, as pupils suggested avoiding areas with no job opportunities, emphasising personal responsibility for employment and consequent power and responsibility.

Overall, the pupils' responses largely align with Ulrich's approach, which sees the individual as a morally acting person with obligations (Ulrich, 2008). This is evident in the pupils' focus on ethical consumption decisions, contrasting with Homann's concept, which shifts individual moral obligations to regulatory institutions (Homann & Suchanek, 2005). Ulrich (2008) advocates decision-making based on discourse and collective reasoning. Many pupils indicated

that they shared this view by identifying the influence of the social environment on power and responsibility. They also attributed significant potential for change at the institutional level to large groups, thereby confirming Ulrich's concept of the mutual influence between individual and institutional ethics (Ulrich, 2008). Lastly, Homann and Suchanek (2005) argued that companies contribute to the general welfare, while the pupils primarily viewed large companies negatively.

Conclusion

This study explored eighth-grade pupils' conceptions regarding business ethics using data from 33 semi-structured interviews conducted at secondary schools in Southwest Germany. Our findings show that the pupils primarily emphasised personal consumption decisions, while political activities received less attention. Most arguments were characterised as fragmented conceptions. We also identified some content-specific misconceptions. Below, we outline key conclusions along with practical and research implications.

From a pedagogical perspective, the diversity of pupil conceptions and prevalent misconceptions should be addressed, for instance, through adaptive teaching strategies (Aprea, 2015). The pupils demonstrated strong awareness of personal responsibilities and often responded by applying multiple perspectives; however, for instance, they lacked knowledge of state responsibilities. While we acknowledge that the educational curriculum in Southern Germany focuses on companies in Grade 9 and state institutions in Grade 10, emphasis on the systemic perspective as early as Grade 8 could enhance pupils' overall economic awareness, particularly regarding possible state intervention. By building on pupils' recognition that the social environment influences consumer power and responsibility, teachers could integrate this notion into their teaching. In light of the various misconceptions, not only regarding the state's role but also concerning pupils' negative view of large companies, multiple perspectives should be continuously considered in economic education. Loerwald (2017) also advocates this,

recommending distinguishing and shifting between different perspectives, such as from the micro to the macro level or from a short- to a long-term viewpoint. The majority of misconceptions in our study were revealed in the context of such perspective shifts.

As with every study, this research has (methodological) limitations. First, we conducted interviews with a limited number of pupils from Southwest Germany which has the advantage of comparability of the interviewees. Nevertheless, a more heterogeneous and larger sample would be valuable to enhance the ability to draw broader conclusions. The regional focus might have introduced contextual biases related to local educational practices, socioeconomic conditions, or cultural norms. Even though we aimed at a diverse sample by randomly selecting pupils within classes, the effects of different socioeconomic backgrounds and cultural influences on pupils conceptions were not considered and could have impacted the results. Such variables are known to play a significant role in shaping educational experiences and cognitive frameworks. Another limitation is the potential influence of social desirability on the interview responses. Moreover, the validity and reliability of the data collection method could be improved by combining different instruments, such as interviews with concept mapping, to obtain longer and more detailed responses. In particular, concept mapping could provide visual insights into pupils' thought processes, uncovering connections and nuances that might not become apparent in purely verbal interviews.

From a developmental perspective, future research could investigate the elaborateness of pupils' responses and the business ethical level in Grades 9 and 10, examining how pupils' different conceptions shape learning processes and whether teaching has a lasting impact on their views on business ethical issues.

In conclusion, this study investigated pupils' business ethical conceptions in a systematic manner, extending previous research (Aprea & Sappa, 2014; Brandts et al., 2019; Davies & Lundholm, 2012; Klee & Lutter, 2010; Pang & Marton, 2005; Speer & Seeber, 2012). It

highlighted the diversity of pupils' views, particularly in the area of consumption decisions, but also uncovered a negative view of companies. To avoid misconceptions about state responsibilities, competition or power distribution in the business cycle, this study's findings suggest teaching business ethical content from a system perspective from the outset of economic education. Above all, the findings underscore the importance of integrating business ethical content into economics at schools to foster the development of reflective and responsible economic citizens – especially in light of global challenges such as climate change and social injustice.

References

Åkerlind, G. S. (2005). Variation and commonality in phenomenographic research methods. *Higher Education Research & Development*, *24*(4), 321–334. https://doi.org/10.1080/07294360500284672

Aprea, C. (2015). Secondary school students' informal conceptions of complex economic phenomena. *International Journal of Educational Research*, *69*, 12–22. https://doi.org/10.1016/j.ijer.2014.09.002

Aprea, C., & Sappa, V. (2014). Variations of Young Germans' Informal Conceptions of Financial and Economic Crises Phenomena. *Journal of Social Science Education*, *13*(3), 57–67. https://doi.org/10.4119/jsse-710

Ariail, D. L., Smith, K. T., & Smith, L. M. (2021). A Pedagogy for Inculcating Professional Values in Accounting Students: Results from an Experimental Intervention. *Issues in Accounting Education*, *36*(4), 5–40. https://doi.org/10.2308/ISSUES-19-018

Ashworth, P., & Lucas, U. (2000). Achieving Empathy and Engagement: A practical approach to the design, conduct and reporting of phenomenographic research. *Studies in Higher Education*, *25*(3), 295–308. https://doi.org/10.1080/713696153

Barth, M., & Michelsen, G. (2013). Learning for change: An educational contribution to sustainability science. *Sustainability Science*, *8*(1), 103–119. https://doi.org/10.1007/s11625-012-0181-5

Bauman, Y., & Rose, E. (2011). Selection or indoctrination: Why do economics students donate less than the rest? *Journal of Economic Behavior & Organization*, *79*(3), 318–327. https://doi.org/10.1016/j.jebo.2011.02.010

Birke, F., & Seeber, G. (2012). Wage differences in pupils' understanding: an investigation in the context of subject-specific concepts. In T. Retzmann (Ed.), *Entrepreneurship und Arbeitnehmerorientierung: Leitbilder und Konzepte für die ökonomische Bildung in der Schule* (pp. 223–237). Wochenschau Verlag.

Bloemen, A. (2009). *Subject-specific and pupils' conceptions of sustainability: a contribution to the didactic reconstruction of political education* (Vol. 12). BIS-Verlag.

Böhmer, N., & Cebulla, B. (2011). Pupils' conceptions of the labour market. In D. Lange & S. Fischer (Eds.), *Politik und Wirtschaft im Bürgerbewusstsein: Untersuchungen zu den fachlichen Konzepten von Schülerinnen und Schülern in der politischen Bildung* (pp. 163–178). Wochenschau-Verlag.

Brandts, J., Busom, I., Lopez-Mayan, C., Panad&eacute, & s, J. (2019). Dispelling Misconceived Beliefs About Rent Control: Insights from a Field and a Laboratory Experiment. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3384538

Calder, W., & Dautremont-Smith, J. (2009). 'Higher education: More and more laboratories for inventing a sustainable future'. In J. C. Dernbach (Ed.), *Agenda for a Sustainable America* (pp. 93–107). Environmental Law Institute.

Chi, M. T. H. (2005). Commonsense Conceptions of Emergent Processes: Why Some Misconceptions Are Robust. *Journal of the Learning Sciences*, *14*(2), 161–199. https://doi.org/10.1207/s15327809jls1402_1

Cipriani, G. P., Lubian, D., & Zago, A. (2009). Natural born economists? *Journal of Economic Psychology*, *30*(3), 455–468. https://doi.org/10.1016/j.joep.2008.10.001

Cowton, C. J., & Cummins, J. (2003). Teaching Business Ethics in UK Higher Education: Progress and Prospects. *Teaching Business Ethics*, *7*(1), 37–54. https://doi.org/10.1023/A:1022665221990

Davies, P. (2023). Students' Economic Conceptions: Theory and Evidence. In F. Birke, T. Kaiser, L. Oberrauch, & B. Remmele (Eds.), *Ökonomische Bildung als Allgemeinbildung: Festschrift zu Günther Seebers 65. Geburtstag* (pp. 39–50). Springer Fachmedien. https://doi.org/10.1007/978-3-658-38560-6_4

Davies, P., & Lundholm, C. (2012). Students' understanding of socio-economic phenomena: Conceptions about the free provision of goods and services. *Journal of Economic Psychology*, *33*(1), 79–89. https://doi.org/10.1016/j.joep.2011.08.003

Dierksmeier, C., & Pirson, M. (2010). The Modern Corporation and the Idea of Freedom. *Philosophy of Management*, *9*(3), 5–25. https://doi.org/10.5840/pom2010932

Duit, R., & Treagust, D. F. (2003). Conceptual change: A powerful framework for improving science teaching and learning. *International Journal of Science Education*, *25*(6), 671–688. https://doi.org/10.1080/09500690305016

Ekström, L., & Lundholm, C. (2021). 'How Much Politics Is There'?: Exploring Students' Experiences of Values and Impartiality from an Epistemic Perspective. *Journal of Political Science Education*, *17*(sup1), 616–633. https://doi.org/10.1080/15512169.2020.1730863

Ferrell, O. C., & Fraedrich, J. (1991). *Business ethics: Ethical decision making and cases*. Houghton Mifflin Co.

Friebel, S., Kirchner, V., & Loerwald, D. (2013). The regional economic area as a social space of appropriation for pupils. *Zeitschrift für Ökonomische Bildung*, *2*, 42–61. https://doi.org/10.7808/zfoeb.1.2.75

Friebel, S., Kirchner, V., & Loerwald, D. (2016). Pupils' conceptions of electricity trading: a qualitative interview study in the field of economic energy education. *Zeitschrift für Ökonomische Bildung*, *5*, 169–189. https://doi.org/10.7808/0508

Gandz, J., & Hayes, N. (1988). Teaching business ethics. *Journal of Business Ethics*, *7*(9), 657–669. https://doi.org/10.1007/BF00382975

Gardner, H. (2006). *Changing Minds: The Art and Science of Changing Our Own and Other Peoples Minds*. Harvard Business Review Press.

German Education Server. (2023, October 16). *Curricula of the individual federal states*. Deutscher Bildungsserver. Ihr Wegweiser Zur Bildung. https://www.bildungsserver.de/lehrplaene-400-de.html

Ghoshal, S. (2005). Bad Management Theories are Destroying Good Management Practices. *Academy of Management Learning & Education*, *4*(1), 75–91. https://doi.org/10.5465/AMLE.2005.16132558

Goel, A. K., Gómez de Silva Garza, A., Grué, N., Murdock, J. W., Recker, M. M., & Govindaraj, T. (1996). Towards design learning environments — I: Exploring how devices work. In C. Frasson, G. Gauthier, & A. Lesgold (Eds.), *Intelligent Tutoring Systems* (pp. 493–501). Springer. https://doi.org/10.1007/3-540-61327-7_148

Hahn, T., Figge, F., Pinkse, J., & Preuss, L. (2010). Trade-offs in corporate sustainability: You can't have your cake and eat it. *Business Strategy and the Environment*, *19*(4), 217–229. https://doi.org/10.1002/bse.674

Haucap, J., & Just, T. (2010). Not guilty? Another look at the nature and nurture of economics students. *European Journal of Law and Economics*, *29*(2), 239–254. https://doi.org/10.1007/s10657-009-9119-5

Heiduk, N. (2019). Controversial competency profiles: which skills are required for responsible consumer behaviour? In C. Bala, M. Buddensiek, P. Maier, & W. Schuldzinski (Eds.), *Verbraucherbildung: Ein weiter Weg zum mündigen Verbraucher* (Vol. 10, pp. 61–82). Verbraucherzentrale NRW. https://doi.org/10.15501/978-3-86336-924-8_4

Hellmich, S. N. (2019). Are People Trained in Economics "Different," and if so, Why? A Literature Review. *The American Economist*, *64*(2), 246–268. https://doi.org/10.1177/0569434519829433

Herbert, S., & Pierce, R. (2013). Gesture as data for a phenomenographic analysis of mathematical conceptions. *International Journal of Educational Research*, *60*, 1–10. https://doi.org/10.1016/j.ijer.2013.03.004

Hmelo, C. E., Holton, D. L., & Kolodner, J. L. (2000). Designing to Learn about Complex Systems. *The Journal of the Learning Sciences*, *9*(3), 247–298.

Hollier, G., Blanckenship, D., & Jones, I. (2013). College business students attitudes toward ethics. *Journal of Business and Behavioral Sciences*, *25*(1), 54.

Homann, K. (1999). ´The relevance of economics for the implementation of ethical objectives`. In W. Korff (Ed.), *Handbuch der Wirtschaftsethik* (pp. 322–343). Gütersloher Verl.-Haus.

Homann, K., & Blome-Drees, F. (1992). *Business and corporate ethics* (Vol. 1721). Vandenhoeck & Ruprecht.

Homann, K., & Suchanek, A. (2005). *Economics: an introduction*. Mohr Siebeck GmbH & Co. KG.

Ifcher, J., & Zarghamee, H. (2018). The rapid evolution of homo economicus: Brief exposure to neoclassical assumptions increases self-interested behavior. *Journal of Behavioral and Experimental Economics*, *75*, 55–65. https://doi.org/10.1016/j.socec.2018.04.012

Ignell, C., Davies, P., & Lundholm, C. (2013). Swedish Upper Secondary School Students' Conceptions of Negative Environmental Impact and Pricing. *Sustainability*, *5*(3), 982–996. https://doi.org/10.3390/su5030982

Ignell, C., Davies, P., & Lundholm, C. (2017). Understanding 'Price' and the Environment: Exploring Upper Secondary Students' Conceptual Development. *Journal of Social Science Education*, 1.17 MB. https://doi.org/10.4119/UNIBI/JSSE-V16-I1-1556

Jaganjac, B., Abrahamsen, L. M., Olsen, T. S., & Hunnes, J. A. (2024). Is It Time to Reclaim the 'Ethics' in Business Ethics Education? *Journal of Business Ethics*, *190*(1), 1–22. https://doi.org/10.1007/s10551-023-05400-5

Jonas, H. (1979). *The principle of responsibility: an attempt at an ethics for technological civilisation* (3rd ed.). Suhrkamp.

Kahler, M. (2011). *Economic education in children with a special focus on the topic of money*.

Kaiser, T., Birke, F., & Lutter, A. (2015). Pupils' concepts of regulatory policy issues: a phenomenographic study. *Zeitschrift für Didaktik der Gesellschaftswissenschaften*, *1*(6), 92–110.

Kaiser, T., Oberrauch, L., & Seeber, G. (2020). Measuring economic competence of secondary school students in Germany. *The Journal of Economic Education*, *51*(3–4), 227–242. https://doi.org/10.1080/00220485.2020.1804504

Klee, A., & Lutter, A. (2010). "Greedy Buyers, Amoral Speculators and Lacking State Control": Pupils Conceptions about the Crisis and their Relevance for Political and Economic Learning. *JSSE - Journal of Social Science Education*, *9*(1), 59–65. https://doi.org/10.4119/jsse-512

Kleinschmidt, M., Fischer, Sebastian, Fischer, Florian, & Lange, Dirk. (2015). Globalisation, global inequality, and development in pupils' perceptions: an empirical study of learning prerequisites as a starting point for designing global education. *Zeitschrift für internationale Bildungsforschung und Entwicklungspädagogik*, *38(3)*, 26–30. https://doi.org/10.25656/01:14055

Kölzer, C. (2014). *'As long as I get a job later': young people with a lower secondary school background and their perceptions of the world of work and coping strategies*. Transcript-Verlag.

Küng, H. (1990). *Project global ethos* (3rd ed.). Piper.

Küng, H. (2010). *Doing business responsibly: why economics needs morality*. Piper.

Küpper, H.-U. (2007). Business Ethics in Germany: Problems, Concepts, and Functions. *Zeitschrift für Wirtschafts- Und Unternehmensethik*, *8*(3), 250–269.

Kvale, S. (1996). *InterViews: An introduction to qualitive research interviewing*. Sage.

Lange, D., & Haarmann, M.-P. (2011). Malleable or formative economy? Civic awareness of pupils regarding the causes of the financial crisis. In D. Lange & S. Fischer (Eds.), *Politik und Wirtschaft im Bürgerbewusstsein: Untersuchungen zu den fachlichen Konzepten von Schülerinnen und Schülern in der politischen Bildung* (pp. 61–74). Wochenschau-Verl.

Lange, K. (2012). Power and powerlessness? Pupils' conceptions and attitudes towards social orders and social inequality. *Zeitschrift für Didaktik der Gesellschaftswissenschaften*, *3*(1), 32–53.

Lemme, L., & Neuhof, J. (2014). Ways of understanding the state: an empirical study from the learners' perspective. In G. Weißeno & C. Schelle (Eds.), *Empirische Forschung in gesellschaftswissenschaftlichen Fachdidaktiken: Ergebnisse und Perspektiven* (pp. 111–125). Springer.

Lenk, H., & Maring, M. (Eds.). (1992). *Economy and ethics* (Nachdr.). Reclam.

Lenk, L.-U. (2011). Pupils' conceptions and social science perspectives on social justice. In D. Lange & S. Fischer (Eds.), *Politik und Wirtschaft im Bürgerbewusstsein: Untersuchungen zu den fachlichen Konzepten von Schülerinnen und Schülern in der politischen Bildung* (pp. 149–162). Wochenschau-Verl.

Loerwald, D. (2017). Multiperspectivity and economic education. In T. Engartner, B. Krisanthan, & Gesellschaft für Politikdidaktik und Politische Jugend- und Erwachsenenbildung (Eds.), *Wie viel ökonomische Bildung braucht politische Bildung?* (pp. 61–69). Gesellschaft für Politikdidaktik und Politische Jugend- und Erwachsenenbildung, Schwalbach/Ts. Wochenschau Verlag.

Loerwald, D. (2020). Economic education in Germany. *List Forum für Wirtschafts- und Finanzpolitik*, *45*(3), 239–253. https://doi.org/10.1007/s41025-020-00187-z

Loerwald, D., & Schreiber, G. (2020). Knowledge transfer using the example of business ethics: content areas, approaches, and scientific ways of thinking in ethically grounded economic education. In D. Loerwald (Ed.), *Ökonomische Erkenntnisse verständlich vermitteln: Herausforderungen für Wirtschaftswissenschaften und ökonomische Bildung* (pp. 191–218). Springer Fachmedien. https://doi.org/10.1007/978-3-658-32753-8_10

Lutter, A. (2018). Against the neglect of the subjective dimension of economic phenomena. In B. Weber (Ed.), *Wirksamer Wirtschaftsunterricht: Aus der Perspektive von Theorie und*

Praxis sowie unterschiedlichen Fachkulturen (pp. 154–162). Schneider Verlag Hohengehren GmbH.

Maring, M. (2014). Sectoral ethics in interdisciplinary dialogue. In M. Maring (Ed.), *Bereichsethiken im interdisziplinären Dialog. Schriftenreihe des Zentrums für Technik und Wirtschaftsethik am Karlsruher Institut für Technologie.* (Vol. 6, pp. 9–23). KIT Scientific Publishing.

Marton, F. (1981). Phenomenography? Describing conceptions of the world around us. *Instructional Science*, *10*(2), 177–200. https://doi.org/10.1007/BF00132516

Marton, F., & Booth, S. (1997). *Learning and awareness*. Lawrence Erlbaum Associates.

Marton, F., & Pong, W. Y. (2005). On the unit of description in phenomenography. *Higher Education Research & Development*, *24*(4), 335–348. https://doi.org/10.1080/07294360500284706

Ministry of education, youth and sports Baden-Württemberg. (2016). *Curriculum for grammar schools: economics / career and study orientation*. https://www.bildungsplaene-bw.de/,Lde/LS/BP2016BW/ALLG/GYM/WBS

Montiel, I., Delgado-Ceballos, J., Ortiz-de-Mandojana, N., & Antolin-Lopez, R. (2020). New Ways of Teaching: Using Technology and Mobile Apps to Educate on Societal Grand Challenges. *Journal of Business Ethics*, *161*(2), 243–251. https://doi.org/10.1007/s10551-019-04184-x

Negru, I., & Dolfsma, W. (2022). Towards a concept of responsibility for economics. *New Political Economy*, *27*(5), 895–905. https://doi.org/10.1080/13563467.2022.2038116

Noel, C. Z., & Hathorn, L. G. (2014). Teaching ethics makes a difference. *Journal of Academic and Business Ethics*, *8*(1).

Palazzo, B. (2002). U.S.-American and German Business Ethics:An Intercultural Comparison. *Journal of Business Ethics*, *41*(3), 195–216. https://doi.org/10.1023/A:1021239017049

Palazzo, B., & Palazzo, G. (2011). Anglo-amerikanische Ansätze der Wirtschafts-und Unternehmensethik. In M. S. Aßländer (Ed.), *Handbuch Wirtschaftsethik* (pp. 132–137). J.B. Metzler.

Pang, M. F., & Marton, F. (2003). Beyond ``lesson study'': Comparing two ways of facilitating the grasp of some economic concepts. *Instructional Science*, *31*(3), 175–194. https://doi.org/10.1023/A:1023280619632

Pang, M. F., & Marton, F. (2005). Learning Theory as Teaching Resource: Enhancing Students' Understanding of Economic Concepts. *Instructional Science*, *33*(2), 159–191. https://doi.org/10.1007/s11251-005-2811-0

Pang, M. F., & Meyer, J. H. F. (2010). Modes of Variation in Pupils' Apprehension of a Threshold Concept in Economics. In J. H. F. Meyer, R. Land, & C. Baillie (Eds.), *Threshold Concepts and Transformational Learning* (pp. 365–381). BRILL.

Peters, R. S. (2015). *Moral Development and Moral Education*. Routledge. https://doi.org/10.4324/9781315710167

Rendtorff, J. D. (2017). *Cosmopolitan business ethics: Towards a global philosophy of management*. Routledge.

Saunders, C., Marcolin, B., & Cherneski, J. (2022). The Role of Students' Personal Values and Ethical Ideologies in Increasing the Importance of Perceptions of Social Responsibility for Business Students: A PRME Directive. *Journal of Management Education*, *46*(5), 920–950. https://doi.org/10.1177/10525629221077320

Schank, C., & Lorch, A. (2019). Sustainability citizenship through economics education Contributions from the German debate on business ethics. *International Journal of Pluralism and Economics Education*, *10*(4), 401. https://doi.org/10.1504/IJPEE.2019.106125

Seeber, G., Retzmann, T., Remmele, B., & Jongebloed, H.-C. (Eds.). (2012). *Educational standards for general economic education: competency model, tasks, and recommendations for action*. Wochenschau-Verlag.

Siegal, M., & Shwalb, D. (1985). Economic justice in adolescence: An Australian-Japanese comparison. *Journal of Economic Psychology*, *6*(3), 313–326. https://doi.org/10.1016/0167-4870(85)90015-7

Slawinski, N., & Bansal, P. (2015). Short on Time: Intertemporal Tensions in Business Sustainability. *Organization Science*, *26*(2), 531–549. https://doi.org/10.1287/orsc.2014.0960

Speer, S., & Seeber, G. (2012). Financial Understanding: A Phenomenographic Access to Students' Concepts of Credits. *JSSE - Journal of Social Science Education*, *12*(2), 42–52.

Steinmann, H. (2008). Towards a conceptual framework for corporate ethics: Problems of justification and implementation. *Society and Business Review*, *3*(2), 133–148. https://doi.org/10.1108/17465680810880062

Sternberg, R. J. (2011). *Cognitive psychology* (6th rev. ed.). Wadsworth Publishing.

Szoncsitz, J. (2020). *Economic education from the perspective of upper secondary school students: an empirical study on conceptions of economics and economics education*. Facultas.

Ulrich, P. (2008). *Integrative economic ethics: Foundations of a civilized market economy*. Cambridge University Press.

Wieland, J. (2014). *Governance Ethics: Global value creation, economic organization and normativity*. Springer International Publishing. https://doi.org/10.1007/978-3-319-07923-3

3. Study 2: Exploring the impact of a digital inquiry-based learning environment on competence development in secondary economic education

Estler, V., Ring, M., & Brahm, T. (2025). Exploring the impact of a digital inquiry-based learning environment on competence development in secondary economic education [Manuscript submitted for publication]. Faculty of Economics and Social Sciences, University of Tübingen.

Abstract

This study examines the impact of a digitally supported inquiry-based learning (IBL) environment on competence development in secondary economic education. While IBL is widely regarded as an effective instructional approach, little is known about its effects in the context of economic education, particularly when combined with digital learning tools. Using a quasi-experimental pretest-posttest design ($N = 445$), this study investigates the effects of a digital IBL environment on students' economic competencies, interest, and attitudes. The findings indicate no significant overall competence gains from the intervention compared to traditional instruction. However, the results reveal gender-specific effects: female students benefited from increased economic interest and intrinsic motivation, whereas male students exhibited a decline in economic interest. These findings highlight the importance of a differentiated implementation of IBL approaches that takes gender-specific learning needs into account and suggest that such approaches should not be applied in isolation but rather in combination with structured instructional support. Furthermore, the necessity of systematically considering the implementation and relevance of digital IBL tools from teachers' perspectives is emphasized in order to ensure their effective integration, particularly in view of the differences in treatment intensity observed among students. The findings contribute to the existing literature by addressing a gap in the understanding of digitally enhanced IBL in economic education and suggest avenues for further research on optimizing IBL interventions for diverse student groups.

Keywords: inquiry-based learning, social sciences, gender, digital environment, secondary school, economic education

Introduction

Numerous ethical scandals have induced a growing debate on the importance of integrating business ethics into both higher education curricula (e.g., Cowton & Cummins, 2003) and school programs (Heiduk, 2019). One key aspect of business ethics is consumer ethics (e.g., Vitell, 2003), with consumer privacy and cybersecurity becoming increasingly prominent issues (Du & Xie, 2021). Scandals such as Amazon's software discriminating against women (Goodman, 2018) and biases against minority groups in ChatGPT (Chen et al., 2023) have underscored the urgency of addressing these concerns. These cases highlight how digitalization is not only transforming business practices but also amplifying ethical risks, raising new questions about fairness, privacy, and accountability. As digital technologies become deeply embedded in consumer interactions and corporate decision-making, ensuring ethical responsibility becomes increasingly complex (Bejinaru, 2019).

Fostering relevant competences poses a significant challenge for educational policy, in particular in the context of digital culture (Luke et al., 2017). While digital ethics is often framed in terms of technology regulation and data security, it is equally an economic issue, requiring individuals to understand how businesses operate in digital markets, how ethical trade-offs arise, and how policies shape digital economies and consumer behavior. Rogerson (2021) emphasizes the importance of introducing digital ethics education early, to lay the foundation for responsible behavior in the digital age. He argues that "it needs to be rebooted because the current effort seems to be too narrowly focused and so is probably ineffective" (Rogerson, 2021).

However, existing educational efforts often focus narrowly on technological literacy, neglecting the broader economic and societal dimensions of digitalization. To equip students with the ability to critically navigate these complexities, innovative pedagogical approaches are needed. Inquiry-Based Learning (IBL), widely recognized for fostering critical thinking and problem-solving in STEM education (European Commission, 2007; National Research

Council, 2000), may offer similar benefits in the context of ethics, economics, and digitalization. A social science perspective is essential in this context because digital ethics is not only a technological issue but also poses economic and societal challenges. Ethical decision-making in digital markets involves basic economic understanding as well as navigating trade-offs between business interests, consumer rights, and regulatory frameworks. Unlike purely technological approaches to digital ethics education, economic education provides students with the analytical tools to understand the incentives behind corporate decision-making, the impact of regulatory policies, and the economic trade-offs involved in ethical business practices (Guryanova et al., 2020). This perspective is crucial for navigating digital markets where consumer rights, corporate ethics, and economic forces are closely intertwined. Yet, research on IBL's potential in that regard is scarce, leaving an important gap in understanding whether this pedagogical approach can support the development of ethical, digital and economic competences.

This study examines the impact of a digitally enhanced IBL environment on students' competence development in economic education. Rather than focusing on the design of the intervention itself, we assess its effectiveness and, crucially, investigate why its impact is not uniform. Specifically, we explore two research questions: (1) To what extent does this learning environment enhance students' competencies? (2) What student characteristics moderate its effects? While IBL is widely recognized for fostering critical thinking and problem-solving, our findings indicate that it does not consistently lead to competence gains across all students. This raises the important question for whom IBL is an effective approach. Understanding these learner-specific factors is essential for ensuring that IBL is not only an effective pedagogical approach in theory but also in practice. With its focus on differential effects among learners, this study provides insights into how economic education can be adapted to better support diverse learners in navigating digital and ethical challenges.

Literature review

Inquiry-based learning

IBL is a self-directed learning approach that promotes active learner participation in constructing knowledge by encouraging the learners to independently develop questions that can be addressed through research-oriented processes (Aditomo et al., 2013; Pedaste et al., 2015). Since there are no clear distinctions between IBL and project-based or problem-based methods (Messner, 2009), we adopt a comprehensive understanding of IBL, aligned with the definition provided by Levy et al. (2010, p. 6): "a cluster of strongly student-centered approaches to learning and teaching that are driven by inquiry or research". During the inquiry process, students engage in questioning, information gathering, and investigative activities aimed at uncovering evidence that facilitates new learning outcomes (Liu et al., 2021; Pedaste et al., 2015). For instance, students develop an interest-driven research question to explore (David, 2008). Inquiry-based tasks operate on the premise that learners are active agents in constructing knowledge by developing their own understanding and gaining insights through meaning-making.

Various studies showed positive effects of IBL on different skills: For instance, Mutlu (2020) reported that seventh-grade students' developed scientific process skills. Both students' conceptual understanding and their ability to explain the concept of density were found to improve through guided IBL in the context of sixth-grade science education (Almuntasheri et al., 2016). Also, deep thinking, knowledge application, complex problem-solving skills, and logical reasoning were found to be supported by well-designed IBL in different studies (Hmelo-Silver et al., 2007; Hu et al., 2008; Voogt & Roblin, 2012). IBL has also been shown to contribute positively to the development of communication skills and ethical judgment (Kreber, 2006). Similar findings to those of Kreber (2006) have been reported by Furtak et al. (2012), Minner et al. (2010), and Alfieri et al. (2011).

However, these results primarily pertain to science education. Particularly in light of the growing relevance of problem orientation and circular thinking in social sciences, IBL is gaining importance (Hermidayani et al., 2019; Iacovidou et al., 2020). However, studies examining the effect of IBL on learner competencies in the field of social sciences are relatively scarce. They often entail small samples and very specific interventions. For example, Deveci (2022) investigated the effects of guided IBL on eighth-grade students' entrepreneurial competencies through. When integrated within business education, significant improvements in general entrepreneurial competency among 74 students ($F = 6.855$, $p = .011$) could be identified. Similarly, the implementation of IBL has been linked to increased student engagement and improved learning outcomes in social sciences (Meitriana et al., 2021). Across two cycles of an IBL implementation, student activation levels were assessed using observation sheets in a cohort of 29 eleventh-grade students. The mean values indicate a positive trend in learning activity. In line with these findings, Kumari et al. (2015) also demonstrated improvements in academic performance through an inquiry-based teaching model in the field of social sciences. Compared to traditional teaching methods, the study found positive effects on academic achievement among 60 ninth-grade students ($t = 1.164$, $p < 0.05$). Correspondingly, the application of a thinking skills-based inquiry learning method has yielded positive effects on learning outcomes in social sciences in Indonesia (Nurhayati et al., 2020). After four instructional sessions, 72 eighth-grade students exhibited significantly improved learning outcomes concerning economic and social science topics in comparison to conventional teaching methods ($t = -6.573$, $p < 0.001$).

Nevertheless, only a limited number of studies investigate the effectiveness of IBL in the social sciences so far. The generalizability of the findings may be limited due to small sample sizes and the absence of control groups. Additionally, the role of digital technologies and the potential boundary conditions of IBL's effectiveness remain largely unexplored. This study

addresses this gap by investigating under what conditions digitally enhanced IBL can support students' learning outcomes.

Inquiry-based learning with digital technologies

Digital technologies have the potential to enhance the effectiveness of IBL since they can enable access to an unlimited amount of digitally represented and readily available information. Specifically, technology use can enrich the inquiry-process, not only in data collection and analysis (De Jong et al., 2014; Hofhues, 2019) but also regarding problem identification, hypothesis formulation, and conclusion drawing (Bónus et al., 2024; Mäeots et al., 2008). Furthermore, internet-supported IBL is intended to encourage students to explore, investigate, and identify alternative ideas, thereby stimulating independent learning (Lin et al., 2012). Additionally, technology has been found to increase motivation and engage students in various learning activities (Ucar & Trundle, 2011). As such, digital tools can be regarded as an extension of teachers' capabilities, facilitating and supporting the research cycle effectively (Casey & Bruce, 2011).

Consequently, it is not surprising that IBL with digital technologies can enhance the development of higher-order thinking skills (Ikpeze & Boyd, 2007; Littleton et al., 2012). Similarly, positive effects on research abilities were found among older students (8th grade, N = 257) using a digital, game-based, inquiry-oriented learning program, with a medium effect size (Cohen's d = 0.46). Beyond fostering inquiry skills, digital learning environments also enhance knowledge of scientific concepts ($t(34) = 11.502$, $p < 0.001$, $d = 1.824$) and attitudes toward science ($t(34) = 3.073$, $p = 0.004$, $d = 0.410$), as demonstrated in a study by Kim (2011) involving 8th grade female students ($N = 35$).

In summary, there is some initial evidence for the effectiveness of IBL enhanced with digital technologies. However, research is mostly focused on STEM subjects. However, even when digital technologies are integrated IBL is not equally effective for everyone. Instead, previous

research demonstrated that the effects might be dependent on boundary conditions, such as learner characteristics and the kind of implementation of (technology-rich) IBL. Both gender differences and the type of guidance in IBL are considered critical factors for the effectiveness of its implementation (e.g., Laursen et al., 2011; Lazonder & Harmsen, 2016). Therefore, the following section presents an overview of the state-of-research concerning these boundary conditions.

Gender-specific differences in the effectiveness of IBL

Previous research on IBL does not only demonstrate generally positive effects but also highlights differences between subgroups regarding the success of IBL (e.g., S. Chen et al., 2016; Wolf & Fraser, 2008). Special attention has been paid to gender differences as IBL is seen as an approach to narrow achievement gaps between male and female students in certain subjects. This is particularly relevant in STEM fields, where gender disparities have been historically prevalent and continue to persist, highlighting the need for innovative approaches to promote educational equity. The findings, however, are not always conclusive.

For instance, it has been found that girls improved their critical thinking skills more effectively after participating in IBL than boys (N = 96, F = 5.969, p = 0.017) although both groups outperformed students in traditional classroom settings (Fuad et al., 2017). Similarly, in terms of conceptual understanding, reasoning and problem-solving skills, self-confidence, and positive attitudes towards mathematics, girls showed greater progress than boys in the same classes (N = 3,212), whereas in non-IBL classes, the opposite pattern was observed (Laursen et al., 2011). Another study in the field of mathematics does not only report significantly higher scores for female learners in IBL compared to traditional courses (N = 193, p = 0.002) but also finds that girls outperformed their male peers within the same IBL environment, with a substantial effect size (Cohen's d = 0.826). In contrast, male learners' performance remained largely unchanged between the two instructional methods (Cooper et al., 2015).

In contrast, other studies have found no gender-specific differences in the effectiveness of IBL. For example, in the social sciences, no gender-specific differences (N = 60) in academic achievement were observed when evaluating the effectiveness of an inquiry-based teaching model (Kumari et al., 2015). Likewise, in the field of the natural sciences, Marshall and Alston (2014) found no significant differences in the positive effects of IBL on either gender (N = 9,981). Regarding the understanding of lunar phases and spatial reasoning in geography, overall learning gains through IBL were comparable for both boys and girls (N = 123). However, girls demonstrated significantly greater improvements in recognizing periodic patterns and understanding the lunar phase cycle, whereas boys outperformed in geometric spatial reasoning and the spatial modeling of orbital paths (Wilhelm, 2009).

To the best of our knowledge, advantages for boys have only been identified in a single empirical study in the field of physics (Wolf & Fraser, 2008). In this study, boys exhibited significantly greater performance gains ($p < .05$) and a significantly more positive attitude towards the natural sciences ($p < .05$) in IBL classrooms compared to girls (N = 165).

In summary, some studies on IBL highlight differences between genders—predominantly in favor of girls, with only one study reporting an advantage for boys. However, since other studies report no significant differences in the effectiveness of IBL across these subgroups, the findings do not allow for robust conclusions.

Hypotheses

Based on previous research on the effectiveness of IBL enhanced with digital technologies, we expect our study to show an improvement in students' skills and attitudes specifically towards concepts of business ethics, as well as an enhancement of scientific working capabilities (i.e., in terms of identifying problems, formulating questions and hypotheses, and data collection and analysis). We also expect increased student activity and motivation as results of the intervention. Furthermore, the use of the inquiry-based digital learning environment is expected to improve handling of digital media.

H1 (confirmatory): The implementation has positive effects on students' (economic) competencies and fosters a more critical attitude toward economics.

As the literature offers no clear conclusions regarding the role of student characteristics in moderating the effects of IBL, the second question and hypothesis remain exploratory. Based on prior research, we investigate whether the effect of IBL differs across specific subgroups (male and female learners).

H2 (exploratory): The effect of implementation might be influenced by students' gender.

Methods

To investigate the effect of the IBL environment and potential effects of gender, we employed a quasi-experimental pretest-posttest design with non-equivalent groups, consisting of an experimental group and a control group. This study was preregistered with a detailed analysis plan to ensure transparency, reduce analytical flexibility, and enhance the credibility of our findings (https://osf.io/mtn2k/?view_only=c3f480e66de245338d5054b4488ea3fc).

Participants

The study was conducted at 15 schools in one of the administrative districts in south-west Germany. Over the course of two school semesters, a total of $N = 445$ students participated, with $N = 293$ (19 classes across 12 schools) in the intervention group and $N = 152$ (10 classes across 6 schools) in the control group (see Table 7). All participants were 8th-grade students with an average age of 13.3 (± 0.5) years.

Table 7

Demographic statistics of sample students

	Experimental			Control		
	N	Mean	SD	N	Mean	SD
Total sample	293	-	-	152	-	-
Female	184	-	-	79	-	-
Male	103	-	-	71	-	-
Age (in years)	293	13.263	0.519	152	13.362	0.522
German native speaker (1/0)	292	0.990	0.101	152	0.947	0.224
>25 books at home (1/0)	293	0.898	0.304	152	0.849	0.360
Education of mother (1/0)	226	0.562	0.497	107	0.542	0.501
Education of father (1/0)	215	0.563	0.497	108	0.500	0.502
Math grade (1-6)	293	2.307	0.983	151	2.517	1.082
German grade (1-6)	292	2.363	0.865	151	2.384	0.847
Grammer school	264	-	-	138	-	-
Comprehensive school	29	-	-	0	-	-
Secondary school	0	-	-	14	-	-

Due to organizational reasons, the classes were not randomly allocated to intervention or control groups. Schools and teachers were asked to partake via economics teachers and the regional school council. All teachers or school administrations who were interested in participating could participate in the intervention and register independently. The control group consists of parallel classes from the same schools and classes from other schools. All control group classes received regular economics instruction.

Study design and procedure

In this study, we investigate the effects of a digital IBL environment implemented in the real-world context of economic education. We are particularly interested in the effects on 8th-grade students' attitudes and competencies. The intervention included access to the digital learning environment Wi.Fo!—Lab for students and teachers, a professional development session for teachers, and a school workshop conducted by university students. Additionally, the teachers had the opportunity to participate in a project challenge with their classes. This challenge

involves the practical application of the knowledge acquired in class and is documented in the form of a short film at the end of the school year. The lab is an IBL environment developed by the Institute for Economic Education in Oldenburg with the support of the PwC Foundation (the authors of this manuscript have not been involved in the development). The environment focuses on the intersection of business, ethics, and digitalization. Its objective is to support economics teachers by combining a digital learning environment with an IBL approach (Koch, 2022). Within the learning environment, three thematic modules (consumer behavior, data management, and the sharing economy) were selected and recommended to teachers for use in the 8th grade. Each module includes various media, such as videos, exercises, texts, or statistics, which students can engage with. This structure provides students with access to a wealth of informational resources. Teachers guide students in using the environment and can create custom assignments for their classes. Homework can also be assigned and submitted via the environment.

Although the teachers received prior training on the implementation of the learning environment and the didactic principles of IBL, they had full autonomy in deciding how to integrate the learning environment into their lessons. As we had no control over the treatment intensity of the learning platform, we assume variations in its use among teachers and, consequently, among students. In comparison, students in the control group participated in regular lessons following the curriculum.

The intervention was implemented in the subject economics, vocational and study orientation ("Wirtschaft, Berufs- und Studienorientierung") over two cohorts—one in the first and the other in the second half of the 2023/2024 school year. Data collection was conducted via an online survey using the "SoSciSurvey" platform. All participating students were asked to complete questionnaires at two measurement points. The t_0 measurement took place before the introduction of the learning environment, and the t_1 measurement after a semester of engaging with the environment. The control group's surveys were conducted at the same time, but

without participation in the program's offerings. Data collection was administered during a regular lesson under the supervision of the teacher. For the first cohort, measurement points were in October 2023 and February 2024, while for the second cohort, measurement points were scheduled for February 2024 and July 2024. Data from both cohorts were analyzed together.

Using a personal code, the pre- and post-data can be linked without allowing any inferences with the students' identity. Both the surveyed students and their legal guardians signed a consent form prior to data collection. This consent form was previously approved by the Ethics Committee of the first author's university (File No. A2.5.4-257_bi) and the Regional Council of the administrative district (File No. RPT0700-6499-4/2/3). The survey primarily consisted of a standardized questionnaire, the components of which are described in detail below.

Instruments

Dependent variables

In line with our first hypothesis, we investigate attitudes towards economics, digital competences, economic competence and knowledge, as well as economic interest as dependent variables. Regarding competence and knowledge, the measures include a curriculum-based competence test (Oberrauch & Seeber, 2021) and items specifically designed to capture potential knowledge development related to the platform's topics. Table 18 in the appendix provides a detailed list of the measures, including their origins, the number of items per construct, and internal consistency values (Cronbach's alpha). To investigate the influence of student characteristics (Hypothesis 2), demographic information was collected as part of the survey.

Covariates

For the current study, various control variables such as cognitive abilities, the Big Five personality factors, students' individual preferences were utilized. Additionally, individual

attitudes towards money and competition were recorded. A sustainability consciousness questionnaire, and test motivation were also part of the control variables. All the described control variables were collected at t_0, i.e., before the start of the intervention (i.e., the provision of the digital learning environment). Table 19 in the appendix provides an overview.

Data analysis

To investigate the first hypothesis, the effects of the treatment on learner competencies, we are combining both cohorts. Significant effects were reported at levels of 1%, 5%, and 10%. 95% confidence intervals were calculated and reported for all estimated parameters. For Likert-scale variables, a factor analysis was conducted to identify latent factors influencing multiple observed variables and reduce data dimensionality. Based on the results, scale values were created for each identified dimension and used as independent and dependent variables in subsequent analyses.

As teachers could choose to participate in the treatment, comparing control and intervention group was identified as a potential problem. To ensure that the classes and teachers in the treatment and control groups are comparable at baseline, a Difference-in-Differences approach was employed to measure the causal effect of a non-randomized intervention by comparing changes in outcomes over time between treatment and control groups (Babu et al., 2017). Additionally, using the Propensity Score Matching method, we identified an appropriate comparison group for the experimental group by creating statistical twins between the treatment and control groups and comparing the outcomes (see Table 21 in the appendix). This method accordingly accounts for differences in observed covariates at baseline (Babu et al., 2017). We continued our analysis with the matched dataset.

Due to the nested structure of the data (students in classes), a multilevel approach is necessary to examine the influence of contextual variables on individual outcomes and to account for the clustered assignment to treatment or control (Raudenbush & Bryk, 2010). At the individual level, the effects of student characteristics such as age and gender on target variables (e.g.,

attitudes towards economic interest) were modeled. At the class level, the impact of classroom characteristics, such as the use of the digital environment, on individual-level outcomes was analyzed (Raudenbush & Bryk, 2002). In addition to multi-level models, regression analyses were conducted to test specific hypotheses that are not influenced by hierarchical data structures.

To maintain the integrity of the statistical analyses, missing data were handled using Multiple Imputation, which generated multiple plausible values for missing data. This approach is based on the assumption of Missing Completely at Random (MCAR) and considers the patterns of missing data in our sample (Graham, 2009). Before applying Multiple Imputation, an analysis of the missing data was performed to understand the nature and extent of the missingness. Specifically, Little's test was used to formally test the MCAR assumption and assess whether attrition was correlated with particular learner or classroom characteristics. To explore the role of learner characteristics (Hypothesis 2), the same statistical procedures were applied. The models were computed separately for male and female learners to examine gender differences.

A post-hoc power analysis using model assumptions derived from the observed data was conducted as a robustness check as the sample size was predetermined (Spybrook et al., 2016). Additionally, a sensitivity analysis was performed for the non-significant outcomes to determine the minimum detectable effect sizes (Dong & Maynard, 2013). This allows for evaluating whether non-significant results are likely due to a true absence of effect or insufficient statistical power.

Results

RQ1 – Effects on students' economic competencies and their attitudes

Although we assumed that the treatment would be beneficial for the students, the analysis did not provide evidence for a difference between intervention and control group. This is evidenced by the descriptive analyses presented in Tables 8 and 9. The comparisons of pretest and posttest

values in Table 8 reveal largely stable results in both groups, with only minor fluctuations. While interest in economic content appears to have slightly increased in both groups, economic competence showed a slight decline. A similar trend is observed for attitudes towards responsibility in the economic system, normative attitudes, and knowledge of data protection. While these developments were observed, their lack of statistical significance implies that we cannot confidently generalize them to the population.

Table 8

Descriptive analysis of items measured in pre- and posttest

Variable	Experimental		Control		Difference experimental	Difference control	P-value
	Pretest	Posttest	Pretest	Posttest			
Economic content interest (1-5)	2.983 (0.783)	3.074 (0.843)	2.862 (0.939)	3.093 (1.091)	0.0915 (0.06)	0.231 (0.152)	0.366
Economic competence (0-11)	5.218 (2.257)	4.922 (2.435)	5.237 (2.121)	5.092 (2.650)	-0.297 (0.178)	-0.145 (0.529)	0.554
Attitudes responsibility (1-5)	3.453 (0.396)	3.392 (0.492)	3.489 (0.368)	3.395 (0.494)	-0.062 (0.096)	-0.094 (0.126)	0.419
Knowledge of data protection (1-5)	3.314 (1.812)	3.099 (2.024)	3.487 (1.775)	3.171 (1.986)	-0.215 (0.212)	-0.316 (0.211)	0.659
Normative attitudes (1-4)	2.608 (0.381)	2.378 (0.736)	2.576 (0.395)	2.357 (0.762)	-0.230 (0.355)	-0.220 (0.367)	0.937

Note. The table reports mean values and standard deviations for the experimental and control groups in both the pretest and posttest, along with the differences between these two measurements. P-values are derived from a linear regression analysis with the treatment as the sole predictor.

Table 9 presents the variables measured exclusively in the posttest. The results, similarly, demonstrate no evidence of a substantial impact of the intervention on economic or digital competencies of all students. Economic knowledge and intrinsic motivation in economics were similar in both groups.

Table 9

Descriptive analysis of items measured in the posttest

Variable	Experimental	Control	P-value
Economic knowledge (1-12)	4.686 (2.512)	4.645 (2.638)	0.872
Intrinsic motivation in economics (1-5)	3.288 (0.883)	3.148 (0.841)	0.286
Knowledge of digital security (1-5)	3.495 (0.500)	3.566 (0.602)	0.196
Digital media handling competencies (1-6)	3.758 (0.895)	3.821 (1.038)	0.523

Note. The table reports mean values and standard deviations for the experimental and control groups in the posttest. P-values are derived from a linear regression analysis with the treatment as the sole predictor.

The difference-in-differences analysis also did not show any significant change in outcomes over time between the treatment and control groups (see Table 20 in the appendix). The multi-level analysis similarly revealed no significant differences between the experimental and control groups regarding the intervention. An overview of the multi-level analysis is presented in Table 10. The sensitivity analysis regarding economic interest, economic competence, and intrinsic motivation indicated that the minimum detectable effect size required to achieve statistical significance was within the expected range (see Figures 12-14 in the appendix). This suggests that either no true effect is present or that any existing effect is smaller than the minimum detectable effect size.

Table 10

Descriptive statistics, bivariate correlation coefficients, and intraclass correlation coefficients

Variable	Female	SES	Economic competence	Economic interest	Intrinsic motivation	Intervention
Female		-0.57	-0.08	-0.02	**-0.62**	0.08
SES	0.01		**0.64**	0.07	0.10	0.25
Economic competence	-0.08	**0.12**		0.34	-0.26	0.00
Economic interest	**-0.13**	0.02	**0.18**		0.25	0.12
Intrinsic motivation	0.00	0.06	**0.14**	**0.43**		0.17
Intervention						
M	0.588	0.776	4.957	3.089	3.239	0.655
SD at the student level		0.055	5.249	0.823	0.629	
SD at the class level	0.037	0.005	1.099	0.056	0.147	0.229
ICC (1)		0.085	0.173	0.064	0.189	
ICC (2)		0.587	0.762	0.510	0.781	

Note. N = 444 students in 29 classes; Correlation coefficients at the student level in the lower triangle, and correlation coefficients at the class level in the upper triangle; ICC(1) = Intraclass correlation coefficient 1, i.e., proportion of between person variance to the total variance; ICC(2) = Intraclass correlation coefficient 2, i.e., reliability of aggregated variable; Correlation coefficients were computed in R (version 4.4.2 (2024-10-31 ucrt)) using the package misty (Yanagida, 2024); Statistically significant results at $\alpha = .05$ are shown in bold.

RQ2 – Treatment effect for male and female learners

To investigate effects based on different learner characteristics, male and female learners were investigated separately. For only female learners, the multi-level model at the class level regarding economic interest, with the treatment as the sole predictor, suggests a small to medium effect size ($\hat{\beta}$ = 0.351, SE = 0.149, df = 24.051, p = 0.027), indicating that the intervention had a statistically significant impact on girls' economic interest. Moreover, significant differences in intrinsic motivation are also observed when comparing female learners with each other ($\hat{\beta}$ = 0.461, SE = 0.143, df = 92.157, p = 0.002). Additionally, the intervention is strongly correlated with both economic interest (r = 0.60) and intrinsic

motivation (r = 0.60) of female learners (see Table 11). The ICC (1) values indicate that 9.5% of the variance in economic interest and 18.8% of the variance in intrinsic motivation can be attributed to differences at the class level. A simulation-based power analysis using model assumptions derived from the observed data confirmed that the statistical power to detect these effects was 86% for economic interest and 91.5% for intrinsic motivation, thus, exceeding the commonly recommended threshold of 80% and indicating that the results are statistically robust and reliable (see Table 22 in the appendix).

Table 11

Descriptive statistics, bivariate correlation coefficients, and intraclass correlation coefficients for female learners

Variable	Economic interest	Intrinsic motivation	Intervention
Economic interest		0.16	**0.60**
Intrinsic motivation	**0.40**		**0.60**
Intervention			
M	2.993	3.210	0.660
SD at the student level	0.712	0.560	
SD at the class level	0.075	0.129	0.229
ICC (1)	0.095	0.188	
ICC (2)	0.487	0.677	

Note. N = 263 students in 29 classes; correlation coefficients at the student level in the lower triangle, and correlation coefficients at the class level in the upper triangle; ICC(1) = Intraclass correlation coefficient 1, i.e., proportion of between person variance to the total variance; ICC(2) = Intraclass correlation coefficient 2, i.e., reliability of aggregated variable; correlation coefficients were computed in R (version 4.4.2 (2024-10-31 ucrt)) using the package misty (Yanagida, 2024); statistically significant results at α = .05 are shown in bold.

For male adolescents, however, the results show the opposite pattern compared to female learners. The multi-level model regarding economic interest indicates a medium effect in the negative range ($\hat{\beta}$ = -0.478, SE = 0.193, df = 30.699, p = 0.019), suggesting that the intervention had a statistically significant but negative impact on economic interest in this group. A strong

negative correlation (r = -0.61) exists between economic interest and intervention participation (see Table 12). Through the ICC(1) value, we observe a small to moderate influence of class membership on economic interest (11.9%). A simulation-based power analysis using model assumptions derived from the observed data confirmed that the power to detect the effect was 89.5%, which suggests that the results are statistically robust and reliable (see Table 22 in the appendix).

Table 12

Descriptive statistics, bivariate correlation coefficients, and intraclass correlation coefficients for male learners

Variable	Economic interest	Intervention
Economic interest		**-0.61**
Intervention		
M	3.244	0.639
SD at the student level	0.859	
SD at the class level	0.116	0.234
ICC (1)	0.119	
ICC (2)	0.468	

Note. N = 181 students in 29 classes; correlation coefficients at the student level in the lower triangle, and correlation coefficients at the class level in the upper triangle; ICC(1) = Intraclass correlation coefficient 1, i.e., proportion of between person variance to the total variance; ICC(2) = Intraclass correlation coefficient 2, i.e., reliability of aggregated variable; correlation coefficients were computed in R (version 4.4.2 (2024-10-31 ucrt)) using the package misty (Yanagida, 2024); statistically significant results at $\alpha = .05$ are shown in bold.

Discussion

Our study found no evidence of a significant effect of digitally supported IBL compared to traditional instruction on (economic) competencies, leading to the rejection of H1. These findings contradict previous studies in the social sciences, which have demonstrated positive effects of IBL on students' learning activity (Meitriana et al., 2021), academic performance

(Kumari et al., 2015; Nurhayati et al., 2020), and entrepreneurial competencies (Deveci, 2022). However, similar findings have been reported in some studies in the natural sciences. In these studies, no significant correlation between IBL and performance improvements has been identified (Jerrim et al., 2019; Miller, 2014).

Similar to previous literature (Kaiser & Oberrauch, 2023), the present study descriptively indicated a slight increase in economic interest in both experimental and control groups following economic coursework. However, a notable observation in this context is the slight decline in economic competence in both groups, which contradicts prior findings for a similar student population (Kaiser & Oberrauch, 2023). As the differences are not significant, however, we cannot be sure whether this development is visible beyond our sample. This discrepancy to the literature could be attributed to the relatively high proportion of variance explained by class membership in economic competence.

Since the teachers had full control over the use of the platform in their own classroom, we assume that there are major differences in how they used the IBL-lab. These treatment intensity differences were anecdotally confirmed by teachers and could be seen as a potential explanation for the absence of evidence for the effect of IBL on competence development in our context. Previous research has shown, for instance, that a higher treatment intensity is relevant for significant performance improvements (Zafra-Gómez et al., 2014). At the same time, the degree of instructional guidance may also be a crucial factor. Other studies have demonstrated that both the nature and intensity of guidance are relevant for the success of IBL methods (Lazonder & Harmsen, 2016), and that particularly a high level of guidance is important for the effectiveness of IBL for secondary school students (Jerrim et al., 2019). Both missing treatment intensity and too little guidance could help explain the absence of evidence for an overarching effect.

Another possible explanation for the observed decline in economic competence could be the varying effectiveness of the intervention for different subgroups of students. The present study

identified significant gender-specific effects on economic interest and intrinsic motivation, which partially contradict previous research. For instance, no significant gender differences in academic performance through IBL have been found in the social sciences (Kumari et al., 2015). Similarly, Marshall and Alston (2014) found no gender-specific differences in learning success through IBL in the natural sciences. A similar pattern has been observed in geography, where overall learning gains were comparable between genders, however, differences in specific subdomains, such as better spatial thinking among boys and better recognition of cyclical patterns among girls, could be detected (Wilhelm, 2009).

The gender-specific findings of the present study indicate a positive influence of IBL on economic interest, particularly among female students. Moreover, an increase in intrinsic motivation was observed among female learners. From a natural sciences perspective, these results align with previous studies suggesting that IBL may be particularly beneficial for girls. Research has shown that girls achieve significantly greater gains in critical thinking skills through IBL than boys (Fuad et al., 2017). Similarly, in mathematics, girls have demonstrated greater improvements in conceptual understanding, logical reasoning, problem-solving skills, self-confidence, and positive attitudes than their male counterparts (Laursen et al., 2011). Cooper et al. (2015) also found that girls exhibited significantly stronger performance improvements in an IBL-based mathematics intervention compared to boys. Overall, these findings as well as our study results suggest that IBL may have particularly positive effects on motivation and interest among female learners. A possible explanation is that IBL methods emphasize independent problem-solving and reflection, which may align more closely with the learning behaviors of many girls.

In contrast, a negative effect on economic interest was observed among boys. This finding contradicts a study in the natural sciences, which reported that boys achieved significant performance improvements through IBL in physics instruction and developed a more positive attitude toward science (Wolf & Fraser, 2008). The discrepancy suggests that the effectiveness

of IBL may be highly dependent on content design and subject area. While boys may benefit more from IBL when learning is exploratory and experimental—as is often the case in the natural sciences – the economic and ethical topics of the present study may be less aligned with their interests and learning preferences.

Overall, the initially formulated (exploratory) H2 can be confirmed. The effect of implementation appears to depend on gender as a student characteristic. Nevertheless, the missing evidence of an overall effect of the IBL method on students' performance is rather worrisome and needs to be further examined.

Conclusion

The present study examined the effects of a digitally supported IBL environment in economic education. The findings indicate a lack of evidence for a significant competence gain resulting from the intervention. However, they emphasize the gender-specific effects of IBL. While female students benefit significantly from the IBL method, negative effects are observed for male students. In this respect, the study extends existing literature by exploring the heterogeneous effects of digitally supported IBL environments on economic education, particularly in the development of economic competencies.

Based on these findings, it seems necessary to revise the investigated IBL intervention in at least two regards: first of all, the implementation of the intervention needs to be further controlled, for instance, by providing further guidelines regarding implementation intensity and teacher support. Second, our findings suggest that IBL as a teaching method could be particularly suitable for female students. Accordingly, it could be worthwhile to further investigate this effect and to provide tailored learning material for different learner subgroups. While the intervention may help to mitigate disadvantages faced by female students in economics (Haag & Brahm, 2025), additional measures are necessary to foster economic interest among male students. IBL should not be considered in isolation but rather in combination with other established teaching approaches. For instance, Hwang et al. (2015)

suggest a game-based variant in combination with IBL, as opposed to purely web-based IBL, and demonstrated positive effects on learning performance, motivation, and student satisfaction. Furthermore, as briefly mentioned above, the findings highlight the necessity of support measures for teachers (Voet & De Wever, 2018). A relatively large proportion of variance can be attributed to class- and school-related factors, leading to inconsistent implementation of the digital learning environment, which may have affected the intervention's effectiveness. Consequently, to maximize the impact of IBL with digital media, targeted teacher training and clear implementation guidelines are essential.

Despite these insights and practical implications, several limitations of the study must be considered. Because of the limited sample size, potential effects may not have been detected due to insufficient statistical power. Additionally, the focus on a specific geographical context limits the generalizability of the findings. Although the risk of contamination is low, self-selection and omitted variable bias may still impair our ability to provide a causal interpretation of the results. Another critical aspect is the lack of control over how teachers implemented the intervention which apparently led to high variance in the implementation intensity of the IBL. Moreover, the instructional methods used in the control group were not standardized, leaving the nature of how traditional teaching was conducted in these classes open. Additionally, the intervention period of only one semester with limited instructional hours may have further weakened the implementation intensity and consequently, the effectiveness of the intervention.

Thus, important questions remain open for further investigation. Future research should examine which specific factors contribute to ensuring that IBL achieves its expected overall effects also in economic education. Additionally, it is crucial to explore which adjustments of the IBL implementation are necessary to better support male learners. In particular, a detailed analysis of the treatment intensity would also be beneficial to determine how IBL can be effective. Further investigations into implementation strategies are also warranted, particularly regarding the role of teacher guidance in the success of digitally supported IBL concepts. These

open questions highlight the need for further research and emphasize the importance of continuously adapting IBL in economic education to meet diverse learning needs.

References

Aditomo, A., Goodyear, P., Bliuc, A.-M., & Ellis, R. A. (2013). Inquiry-based learning in higher education: Principal forms, educational objectives, and disciplinary variations. *Studies in Higher Education*, *38*(9), 1239–1258. https://doi.org/10.1080/03075079.2011.616584

Alfieri, L., Brooks, P. J., Aldrich, N. J., & Tenenbaum, H. R. (2011). Does discovery-based instruction enhance learning? *Journal of Educational Psychology*, *103*(1), 1–18. https://doi.org/10.1037/a0021017

Almuntasheri, S., Gillies, R. M., & Wright, T. (2016). The Effectiveness of a Guided Inquiry-Based, Teachers' Professional Development Programme on Saudi Students' Understanding of Density. *Science Educational International*, *27*, 16–39.

Babu, S. C., Gajanan, S. N., & Hallam, J. A. (2017). Chapter 11 - Methods of Program Evaluation: An Analytical Review and Implementation Strategies. In S. C. Babu, S. N. Gajanan, & J. A. Hallam (Eds.), *Nutrition Economics* (pp. 205–230). Academic Press. https://doi.org/10.1016/B978-0-12-800878-2.00011-6

Barry, D., & Breuer, K. (2012). Die Einstellung zu Geld bei Jugendlichen und jungen Erwachsenen–Entwicklung eines Instruments in deutscher Sprache. In *Forschungscluster „Gesellschaftliche Abhängigkeiten und soziale Netzwerke": Gesellschaftliche Teilhabe trotz Schulden.* (pp. 9–25). Symposium 'Gesellschaftliche Teilhabe trotz Schulden? -- Perspektiven Interdisziplinären Wissenstransfers', Wiesbaden. Springer VS.

Bónus, L., Antal, E., & Korom, E. (2024). Digital Game-Based Inquiry Learning to Improve Eighth Graders' Inquiry Skills in Biology. *Journal of Science Education and Technology*, *33*, 462–478. https://doi.org/10.1007/s10956-024-10096-x

Casey, L., & Bruce, B. C. (2011). The Practice Profile of Inquiry: Connecting Digital Literacy and Pedagogy. *E-Learning and Digital Media*, *8*(1), 76–85. https://doi.org/10.2304/elea.2011.8.1.76

Chen, K., Shao, A., Burapacheep, J., & Li, Y. (2023). *How GPT-3 responds to different publics on climate change and Black Lives Matter: A critical appraisal of equity in conversational AI*. arXiv:2209.13627. https://doi.org/10.48550/arXiv.2209.13627

Chen, S., Huang, C.-C., & Chou, T.-L. (2016). The Effect of Metacognitive Scaffolds on Low Achievers' Laboratory Learning. *International Journal of Science and Mathematics Education*, *14*(2), 281–296. https://doi.org/10.1007/s10763-015-9691-9

Cipriani, G. P., Lubian, D., & Zago, A. (2009). Natural born economists? *Journal of Economic Psychology*, *30*(3), 455–468. https://doi.org/10.1016/j.joep.2008.10.001

Cooper, T. E., Bailey, B., & Briggs, K. S. (2015). Gender Differences in Achievement in an Inquiry-Based Learning Precalculus Course. *International Electronic Journal of Mathematics Education*, *10*(2), 97–110. https://doi.org/10.29333/iejme/294

Cowton, C. J., & Cummins, J. (2003). Teaching Business Ethics in UK Higher Education: Progress and Prospects. *Teaching Business Ethics*, *7*(1), 37–54. https://doi.org/10.1023/A:1022665221990

David, J. (2008). What research says about project-based learning. *Educational Leadership*, *65*, 80–82.

De Jong, T., Sotiriou, S., & Gillet, D. (2014). Innovations in STEM education: The Go-Lab federation of online labs. *Smart Learning Environments*, *1*(1), 3. https://doi.org/10.1186/s40561-014-0003-6

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. Plenum.

Deveci, I. (2022). Effect of Guided Inquiry-Based Learning Integrated with Enterprise Education on the Entrepreneurial Competencies of Middle School Students. *Research Issues in Contemporary Education*, *7*(1), 79–108.

Dong, N., & Maynard, R. (2013). PowerUp!: A Tool for Calculating Minimum Detectable Effect Sizes and Minimum Required Sample Sizes for Experimental and Quasi-

Experimental Design Studies. *Journal of Research on Educational Effectiveness*, 6(1), 24–67. https://doi.org/10.1080/19345747.2012.673143

Du, S., & Xie, C. (2021). Paradoxes of artificial intelligence in consumer markets: Ethical challenges and opportunities. *Journal of Business Research*, *129*, 961–974. https://doi.org/10.1016/j.jbusres.2020.08.024

European Commission (Ed.). (2007). *Science education now: A renewed pedagogy for the future of Europe.* Office des publications officielles des Communautés européennes.

Falk, A., Becker, A., Dohmen, T., Huffman, D., & Sunde, U. (2016). *The Preference Survey Module: A Validated Instrument for Measuring Risk, Time, and Social Preferences.* IZA Discussion Paper 9674.

Fuad, N. M., Zubaidah, S., Mahanal, S., & Suarsini, E. (2017). Improving Junior High Schools' Critical Thinking Skills Based on Test Three Different Models of Learning. *International Journal of Instruction*, *10*(01), 101–116. https://doi.org/10.12973/iji.2017.1017a

Fülöp, M., Mihály, B., & Roland-Lévy, C. (2008). Adolescents' Perception and Attitude towards Competition in Economic Life: The Role of Societal Change. Coping with Demands of Social and Economic Change. *XIth Conference of the European Association for Research on Adolescence*.

Furtak, E. M., Seidel, T., Iverson, H., & Briggs, D. C. (2012). Experimental and Quasi-Experimental Studies of Inquiry-Based Science Teaching: A Meta-Analysis. *Review of Educational Research*, *82*(3), 300–329. https://doi.org/10.3102/0034654312457206

Gerick, J., & Eickelmann, B. (2017). *Abschlussbericht im Rahmen der wissenschaftlichen Begleitung der Evaluation des Projekts „Lernen mit digitalen Medien" in Schleswig-Holstein.* Universität Hamburg, Universität Paderborn.

Gericke, N., Boeve-de Pauw, J., Berglund, T., & Olsson, D. (2019). The Sustainability Consciousness Questionnaire: The theoretical development and empirical validation of an

evaluation instrument for stakeholders working with sustainable development. *Sustainable Development*, *27*(1), 35–49. https://doi.org/10.1002/sd.1859

Gerlitz, J.-Y., & Schupp, J. (2005). *Zur Erhebung der Big-Five-basierten Persönlichkeitsmerkmale im SOEP*. German Institute for Economic Research (DIW Berlin).

Goodman, R. (2018). *Why Amazon's Automated Hiring Tool Discriminated Against Women*. https://www.aclu.org/news/womens-rights/why-amazons-automated-hiring-tool-discriminated-against

Graham, J. W. (2009). Missing Data Analysis: Making It Work in the Real World. *Annual Review of Psychology*, *60*(1), 549–576. https://doi.org/10.1146/annurev.psych.58.110405.085530

Guryanova, A. V., Smotrova, I. V., Makhovikov, A. E., & Koychubaev, A. S. (2020). Socio-ethical Problems of the Digital Economy: Challenges and Risks. In S. Ashmarina, A. Mesquita, & M. Vochozka (Eds.), *Digital Transformation of the Economy: Challenges, Trends and New Opportunities* (Vol. 908, pp. 96–102). Springer International Publishing. https://doi.org/10.1007/978-3-030-11367-4_9

Haag, L., & Brahm, T. (2025). The Gender Gap in Economic and Financial Literacy: A Review and Research Agenda. *International Journal of Consumer Studies*, *49*(2), e70031. https://doi.org/10.1111/ijcs.70031

Heiduk, N. (2019). Kontroverse Kompetenzprofile: Welche Fähigkeiten erfordert mündiges Konsumverhalten? In C. Bala, M. Buddensiek, P. Maier, & W. Schuldzinski (Eds.), *Verbraucherbildung: Ein weiter Weg zum mündigen Verbraucher* (Vol. 10, pp. 61–82). Verbraucherzentrale NRW. https://doi.org/10.15501/978-3-86336-924-8_4

Heller, K. A., Kratzmeier, H., & Lengfelder, A. (1998). *Matrizen-Test-Manual Band 1. Ein Handbuch mit deutschen Normen zu den Standard Progressive Matrices von J.C. Raven.* Beltz.

Hermidayani, H., Mukhtar, M., & Tambunan, H. (2019). The Effect of Learning Model and Critical Thinking Toward Learning Outcome in Economics of The Tenth Graders in Senior High School. *Proceedings of the Proceedings of the 2nd Annual Conference of Engineering and Implementation on Vocational Education (ACEIVE 2018), November 3, 2018, North Sumatra, Indonesia*. https://doi.org/10.4108/eai.3-11-2018.2285666

Hmelo-Silver, C. E., Duncan, R. G., & Chinn, C. A. (2007). Scaffolding and Achievement in Problem-Based and Inquiry Learning: A Response to Kirschner, Sweller, and Clark (2006). *Educational Psychologist*, *42*(2), 99–107. https://doi.org/10.1080/00461520701263368

Hofhues, S. (2019). Inquiry-Based Learning with Digital Media. In H. A. Mieg (Ed.), *Inquiry-Based Learning – Undergraduate Research* (pp. 375–382). Springer International Publishing. https://doi.org/10.1007/978-3-030-14223-0_35

Hu, S., Kuh, G. D., & Li, S. (2008). The Effects of Engagement in Inquiry-Oriented Activities on Student Learning and Personal Development. *Innovative Higher Education*, *33*(2), 71–81. https://doi.org/10.1007/s10755-008-9066-z

Hwang, G.-J., Chiu, L.-Y., & Chen, C.-H. (2015). A contextual game-based learning approach to improving students' inquiry-based learning performance in social studies courses. *Computers & Education*, *81*, 13–25. https://doi.org/10.1016/j.compedu.2014.09.006

Iacovidou, E., Hahladakis, J. N., & Purnell, P. (2020). A systems thinking approach to understanding the challenges of achieving the circular economy. *Environmental Science and Pollution Research*, *28*(19), 24785–24806. https://doi.org/10.1007/s11356-020-11725-9

Ikpeze, C. H., & Boyd, F. B. (2007). Web-Based Inquiry Learning: Facilitating Thoughtful Literacy With WebQuests. *The Reading Teacher*, *60*(7), 644–654. https://doi.org/10.1598/RT.60.7.5

Jerrim, J., Oliver, M., & Sims, S. (2019). The relationship between inquiry-based teaching and students' achievement. New evidence from a longitudinal PISA study in England. *Learning and Instruction*, *61*, 35–44. https://doi.org/10.1016/j.learninstruc.2018.12.004

Kaiser, T., & Oberrauch, L. (2023). *Economic Education at the Expense of Indoctrination? Evidence from Germany* (SSRN Scholarly Paper No. 4379708). https://doi.org/10.2139/ssrn.4379708

Kaiser, T., Oberrauch, L., & Seeber, G. (2020). Measuring economic competence of secondary school students in Germany. *The Journal of Economic Education*, *51*(3–4), 227–242. https://doi.org/10.1080/00220485.2020.1804504

Kim, H. (2011). Inquiry-Based Science and Technology Enrichment Program: Green Earth Enhanced with Inquiry and Technology. *Journal of Science Education and Technology*, *20*(6), 803–814. https://doi.org/10.1007/s10956-011-9334-z

Koch, M. (2022, February 22). *Konzeption und Realisierung eines virtuellen Lernraums für die unterrichtliche Auseinandersetzung mit dem Spannungsfeld „Wirtschaft—Ethik—Digitalisierung"* [Vortrag]. Jahrestagung 2022 der Deutschen Gesellschaft für Ökonomische Bildung, Online.

Kreber, C. (2006). Research-based teaching in relation to academic practice: Some insights resulting from previous chapters. *New Directions for Teaching and Learning*, *2006*(107), 95–100. https://doi.org/10.1002/tl.250

Kumari, P., Arora, S. K., & Tiwari, S. (2015). Impact of Inquiry-based teaching model on Academic Achievements in Social Science subject of 9th class student of secondary Schools located in urban area. *International Journal of Recent Research Aspects*, *2*(4), 154–158.

Laursen, S., Hassi, M.-L., Kogan, M., Hunter, A.-B., & Weston, T. (2011). *Evaluation of the IBL Mathematics Project: Student and Instructor Outcomes of Inquiry-Based Learning in College Mathematics*. University of Colorado Boulder.

Lazonder, A. W., & Harmsen, R. (2016). Meta-Analysis of Inquiry-Based Learning: Effects of Guidance. *Review of Educational Research*, *86*(3), 681–718. https://doi.org/10.3102/0034654315627366

Levy, P., Little, S., McKinney, P., Nibbs, A., & Wood, J. (2010). *The Sheffield companion to inquiry-based learning*. Centre for Inquiry-based Learning in the Arts and Social Sciences (CILASS), The University of Sheffield.

Lin, Y.-H., Liang, J.-C., & Tsai, C.-C. (2012). Effects of different forms of physiology instruction on the development of students' conceptions of and approaches to science learning. *Advances in Physiology Education*, *36*(1), 42–47. https://doi.org/10.1152/advan.00118.2011

Littleton, K., Scanlon, E., & Sharples, M. (Eds.). (2012). *Orchestrating Inquiry Learning*. Routledge. https://doi.org/10.4324/9780203136195

Liu, C., Bano, M., Zowghi, D., & Kearney, M. (2021). Analysing user reviews of inquiry-based learning apps in science education. *Computers & Education*, *164*, 104119. https://doi.org/10.1016/j.compedu.2020.104119

Luke, A., Sefton-Green, J., Graham, P., Kellner, D., & Ladwig, J. (2017). Digital ethics, political economy and the curriculum: This changes everything. In K. Mills, A. Stornaiuolo, & J. Zacher Pandya (Eds.), *Handbook of Writing, Literacies, and Education in Digital Cultures* (pp. 251–263). Routledge. https://doi.org/10.4324/9781315465258

Mäeots, M., Pedaste, M., & Sarapuu, T. (2008). Transforming Students' Inquiry Skills with Computer-Based Simulations. *2008 Eighth IEEE International Conference on Advanced Learning Technologies*, 938–942. https://doi.org/10.1109/ICALT.2008.239

Marshall, J. C., & Alston, D. M. (2014). Effective, Sustained Inquiry-Based Instruction Promotes Higher Science Proficiency Among All Groups: A 5-Year Analysis. *Journal of Science Teacher Education*, *25*(7), 807–821. https://doi.org/10.1007/s10972-014-9401-4

Masur, P. K., Teutsch, D., & Trepte, S. (2017). Entwicklung und Validierung der Online-Privatheitskompetenzskala (OPLIS). *Diagnostica*, *63*(4), 256–268. https://doi.org/10.1026/0012-1924/a000179

Meitriana, M. A., Irwansyah, M. R., & Suwena, K. R. (2021). Inquiry Learning: Strategy to Improve Economic Learning Outcomes and Student Activities. *Journal of Research & Method in Education*, *11*(1), 35–41.

Messner, R. (2009). Forschendes Lernen aus pädagogischer Sicht. In R. Messner, M. Mayer, T. Nöthen, C. Reese, S. Tetzlaff, & U. Backhaus (Eds.), *Schule forscht: Ansätze und Methoden zum forschenden Lernen* (pp. 15–30). edition Körber-Stiftung.

Miller, D. K. G. (2014). *The effect of inquiry-based, hands-on labs on achievement in middle school science*. Liberty University.

Minner, D. D., Levy, A. J., & Century, J. (2010). Inquiry-based science instruction—what is it and does it matter? Results from a research synthesis years 1984 to 2002. *Journal of Research in Science Teaching*, *47*(4), 474–496. https://doi.org/10.1002/tea.20347

Mutlu, A. (2020). Evaluation of students' scientific process skills through reflective worksheets in the inquiry-based learning environments. *Reflective Practice*, *21*(2), 271–286. https://doi.org/10.1080/14623943.2020.1736999

National Research Council. (2000). *Inquiry and the National Science Education Standards: A Guide for Teaching and Learning* (p. 9596). National Academies Press. https://doi.org/10.17226/9596

Niehues, J. (2014). Subjektive Ungleichheitswahrnehmung und Umverteilungspräferenzen – ein internationaler Vergleich. *IW Trends*, *2*. https://doi.org/10.2373/1864-810X.14-02-06

Nurhayati, D. A. W., Putranto, A., Marwa, D. M., & Purwowidodo, A. (2020). Effect of Thinking Skill-Based Inquiry Learning Method on Learning Outcomes of Social Studies: A Quasi-Experimental Study on Grade VIII Students of MTSN 6 Tulungagung. *IOP*

Conference Series: Earth and Environmental Science, *485*(1), 012073. https://doi.org/10.1088/1755-1315/485/1/012073

Oberrauch, L., & Seeber, G. (2021). The impact of mandatory economic education on adolescents' attitudes. *Education Economics*, *30*(2), 208–224. https://doi.org/10.1080/09645292.2021.1967294

Peart, M. T., Gutiérrez-Esteban, P., & Cubo-Delgado, S. (2020). Development of the digital and socio-civic skills (DIGISOC) questionnaire. *Educational Technology Research and Development*, *68*(6), 3327–3351. https://doi.org/10.1007/s11423-020-09824-y

Pedaste, M., Mäeots, M., Siiman, L. A., de Jong, T., van Riesen, S. A. N., Kamp, E. T., Manoli, C. C., Zacharia, Z. C., & Tsourlidaki, E. (2015). Phases of inquiry-based learning: Definitions and the inquiry cycle. *Educational Research Review*, *14*, 47–61. https://doi.org/10.1016/j.edurev.2015.02.003

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd ed.). Sage Publications.

Raudenbush, S. W., & Bryk, A. S. (2010). *Hierarchical linear models: Applications and data analysis methods* (2nd ed.). Sage Publ.

Rogerson, S. (2021). *Rebooting ethics education in the digital age*. Academia Letters. https://dora.dmu.ac.uk/bitstream/2086/20613/2/Rebooting%20ethics%20education%20in%20the%20digital%20age%20prepublication%20version.pdf

Rubinstein, A. (2006). A Sceptic's Comment on the Study of Economics. *The Economic Journal*, *116*(510), C1–C9. https://doi.org/10.1111/j.1468-0297.2006.01071.x

Spybrook, J., Kelcey, B., & Dong, N. (2016). Power for Detecting Treatment by Moderator Effects in Two- and Three-Level Cluster Randomized Trials. *Journal of Educational and Behavioral Statistics*, 41(6), 605–627. https://doi.org/10.3102/1076998616655442

Ucar, S., & Trundle, K. C. (2011). Conducting guided inquiry in science classes using authentic, archived, web-based data. *Computers & Education*, *57*(2), 1571–1582. https://doi.org/10.1016/j.compedu.2011.02.007

Vitell, S. J. (2003). Consumer Ethics Research: Review, Synthesis and Suggestions for the Future. *Journal of Business Ethics*, *43*(1), 33–47. https://doi.org/10.1023/A:1022907014295

Voet, M., & De Wever, B. (2018). Effects of immersion in inquiry-based learning on student teachers' educational beliefs. *Instructional Science*, *46*(3), 383–403. https://doi.org/10.1007/s11251-017-9439-8

Voogt, J., & Roblin, N. P. (2012). A comparative analysis of international frameworks for 21st century competences: Implications for national curriculum policies. *Journal of Curriculum Studies*, *44*(3), 299–321. https://doi.org/10.1080/00220272.2012.668938

Walstad, W. B., & Soper, J. C. (1983). Measuring Economic Attitudes in High School. *Theory & Research in Social Education*, *11*(1), 41–54. https://doi.org/10.1080/00933104.1983.10505442

Wilde, M., Bätz, K., Kovaleva, A., & Urhahne, D. (2009). Überprüfung einer Kurzskala intrinsischer Motivation (KIM). *Zeitschrift Für Didaktik Der Naturwissenschaften*, *15*, 31–45.

Wilhelm, J. (2009). Gender Differences in Lunar-related Scientific and Mathematical Understandings. *International Journal of Science Education*, *31*(15), 2105–2122. https://doi.org/10.1080/09500690802483093

Wise, S. L., & Kong, X. (2005). Response Time Effort: A New Measure of Examinee Motivation in Computer-Based Tests. *Applied Measurement in Education*, *18*(2), 163–183. https://doi.org/10.1207/s15324818ame1802_2

Wolf, S. J., & Fraser, B. J. (2008). Learning Environment, Attitudes and Achievement among Middle-school Science Students Using Inquiry-based Laboratory Activities. *Research in Science Education*, *38*(3), 321–341. https://doi.org/10.1007/s11165-007-9052-y

Yamauchi, K. T., & Templer, D. J. (1982). The Development of a Money Attitude Scale. *Journal of Personality Assessment*, *46*(5), 522–528. https://doi.org/10.1207/s15327752jpa4605_14

Yanagida, T. (2024). *Package 'misty'. Miscellaneous Functions 'T. Yanagida'* (Version 0.6.8) [R (>= 4.2.0); R (>= 4.2.0)].

Zafra-Gómez, J. L., Román-Martínez, I., & Gómez-Miranda, M. E. (2014). Measuring the impact of inquiry-based learning on outcomes and student satisfaction. *Assessment & Evaluation in Higher Education*, *40*(8), 1050–1069. https://doi.org/10.1080/02602938.2014.963836

4. Study 3: Engagement and learner behavior in a digital environment: Implications for secondary economic education

Estler, V., Brahm, T., & Ring, M. (2025). Engagement and learner behavior in a digital environment: Implications for secondary economic education [Manuscript submitted for publication]. Faculty of Economics and Social Sciences, University of Tübingen.

Abstract

In digital learning environments, it is important that students engage with the content since different patterns of engagement are related to learning outcomes. Drawing on log data from 285 eighth-grade students, this study examines secondary school students' behavioral engagement within the environment using multilevel regression and profile analysis. The results indicate that overall behavioral engagement, measured by the number of interactions with the environment, is positively associated with both economic competence development and knowledge. Furthermore, differentiated patterns of learner behavior reveal that specific media types—such as interactive caricatures and training tools—are linked to more favorable learning outcomes. Learner profiles could be clustered into four engagement types (Disengagers, Viewers, Quiz-Takers, All-Rounders), with All-Rounders achieving significantly higher scores in economic learning and digital competencies. These findings underscore the importance of promoting not just higher engagement levels, but also more diverse and active engagement patterns. The study contributes to the literature by transferring established insights from higher education and open online learning contexts to the under-researched field of secondary education and highlights implications for instructional design and teacher training in hybrid learning settings.

Keywords: digital learning environment, secondary education, behavioral engagement, learning analytics

Introduction

In recent years, digital learning platforms have become an increasingly prominent feature of educational practice, offering new opportunities for personalized, flexible, and interactive learning. While their use has been most extensively studied in higher education and informal learning contexts, digital tools are also gaining importance in secondary education, where they are often embedded into the curriculum and designed to support learning both in and outside the classroom. Understanding how students engage with these tools and how their engagement relates to learning outcomes is becoming increasingly important for both educators and platform designers.

Student engagement is widely regarded as a key determinant of academic achievement in traditional and digital contexts alike (e.g., Bergdahl, 2022; Vayre & Vonthron, 2017). It is commonly defined as the investment of time, energy, and effort in learning-related activities (e.g., Fredricks et al., 2004; Henrie et al., 2015). As a multidimensional construct, engagement encompasses behavioral, cognitive, and emotional components. While emotional and cognitive aspects are difficult to capture outside of survey-based research, behavioral engagement—such as task completion, page views, or time on task—can be continuously recorded in digital environments through log data. These indicators, though imperfect, provide an authentic window into students' interaction patterns with the learning platform and are frequently used as proxies for active involvement (Henrie et al., 2015; Li & Baker, 2018).

Many studies from the higher education context suggest that behavioral engagement positively predicts learning outcomes, including course completion and academic performance (Crossley et al., 2016; Doo & Kim, 2024). However, the strength of this relationship varies considerably depending on course design, engagement metrics, and learner characteristics (Dunn & Kennedy, 2019; Macfadyen & Dawson, 2010). Emerging research also indicates that both the level and the type of engagement play a role. Learners who interact with both content and

assessments, often referred to as “all-rounders” tend to outperform those who focus on a single activity or participate only minimally (Anderson et al., 2014; Li & Baker, 2018).

Despite these findings, research on behavioral engagement and learner typologies has largely focused on university students, leaving a notable gap in our understanding of how secondary school students interact with digital learning platforms. This is particularly relevant as younger learners often differ from university students in terms of their self-regulation skills, motivation, and support structures (Bergdahl et al., 2020). These factors, however, are likely to influence how they engage with digital tools. Moreover, most existing studies have been conducted in the context of massive open online courses (MOOCs), which typically lack detailed information about learners’ backgrounds or prior academic achievement and rarely include standardized outcome measures (Li & Baker, 2018). As a result, it remains unclear whether the relationships observed in higher education can be generalized to school-based settings or can meaningfully inform platform design and instructional strategies in secondary education.

The present study addresses this gap by examining engagement and learning outcomes in a platform specifically developed for use in secondary education, within the subject area of economics. Understanding how secondary students engage with such a platform—and how different engagement patterns relate to subject-specific learning outcomes—can thus provide valuable insights for improving the design and implementation of digital tools in school education.

Against this background, the present study uses log data from 285 students across 22 classrooms to investigate not only the overall impact of engagement but also the specific influence of different activity types and user profiles on learning success. By situating the analysis within an authentic school-based setting and leveraging usage data and standardized test scores, this study contributes to the field of digital learning research by offering new insights into the behavioral dynamics of secondary school learners in economics. The findings

inform both theory-driven understandings of engagement in digital environments and the practical design of digital tools that support meaningful learning in formal education contexts.

Literature review

Relevance of engagement in digital settings

Building on the widely accepted conceptualization of student engagement as a multidimensional construct, the framework proposed by Fredricks et al. (2004) is central for distinguishing between behavioral, cognitive, and emotional engagement. This model not only provides a theoretical foundation but also informs the development of validated measurement instruments used in both traditional and digital learning environments (e.g., Appleton et al., 2006; Henrie et al., 2015; Pellas, 2014). Behavioral engagement refers to students' active participation in curricular and extracurricular activities, characterized by sustained effort, persistence, and adherence to institutional norms and expectations. In contrast, cognitive engagement centers on students' mental effort and involves the use of deep learning and self-regulation strategies aimed at understanding the content. Positive emotional reactions to the learning environment, peers, instructors, and familial support are considered key indicators of emotional engagement within the context of social integration (Fredricks et al., 2004; Landis & Reschly, 2013; Van Rooij et al., 2017).

Numerous empirical studies highlight that student engagement is a central factor influencing academic performance (e.g., Alrashidi et al., 2016; Crossley et al., 2016; Kahu & Nelson, 2018), which has led to increasing interest in learning engagement as a predictor of learning outcomes (Bergdahl, 2022). Similarly, learning engagement contributes significantly to student performance in online courses (Vayre & Vonthron, 2017). In this context, different researchers have emphasized the growing importance of learning engagement, citing limited instructor interaction, learner isolation, and reliance on digital communication as contributing factors (Bergdahl, 2022; Bolliger & Halupa, 2018; Cho & Cho, 2014). In prior research on digital

learning environments, learning analytics data have predominantly served as the basis for analyzing specifically behavioral and cognitive engagement (e.g., Crossley et al., 2016; Cutumisu et al., 2015). Behavioral engagement is often assessed using indicators based on activity frequency (Henrie et al., 2015). Typical measures include metrics such as (1) how often students click or view pages (e.g., Li et al., 2016), (2) how many tasks they complete (e.g., Thompson et al., 2012), and (3) how frequently they participate in discussion forums (Peters et al., 2011). However, measuring engagement through log data cannot directly capture learners' mental effort or use of learning strategies. The extent to which log data reflect behavioral or cognitive engagement remains a subject of academic discussion (Li & Baker, 2018). Therefore, it is reasonable to initially interpret these digital data as indicators of observable behavior, in line with the concept of behavioral engagement. Theoretical frameworks also suggest a link between behavioral and cognitive engagement, which supports the validity of analyzing log data from a behavioral perspective (Poellhuber et al., 2019).

In summary, behavioral engagement, in particular, has emerged as a measurable and meaningful component in digital learning environments. Although log data cannot capture all dimensions of engagement, they offer a practical and scalable way to assess how students interact with digital tools. For studies like ours, which analyze platform use in secondary education, focusing on behavioral engagement provides a theoretically grounded and methodologically feasible lens to investigate learning processes in technology-enhanced settings. To better understand the potential of this approach, the following section reviews empirical evidence on the relationship between behavioral engagement and academic outcomes, with a particular focus on digital learning environments.

Relationship between engagement and learning outcomes

Previous research has highlighted engagement as a key predictor of academic success in digital learning environments: In the context of higher education, Doo and Kim (2024) conducted a meta-analysis examining the relationship between learning engagement and learning outcomes

in online learning settings. Their synthesis included 175 effect sizes extracted from 34 eligible studies published between January 2010 and March 2022. The results revealed an average effect size of $g = 0.430$, indicating a small to moderate relationship between engagement and academic performance. Similarly, findings from a study in a fully online undergraduate biology course ($N = 118$) demonstrated that students' engagement—operationalized through their level of participation in course activities such as discussion forum posts, private messaging, and completion of self-assessments—was significantly associated with academic outcomes (Macfadyen & Dawson, 2010). Together, these activity indicators explained 33% of the variance in final course grades ($R^2 = .33$, $p < .001$), with forum participation showing the strongest individual predictive value ($\beta = .44$, $p < .05$).

With a specific focus on behavioral engagement, Morris et al. (2005) examined $N = 354$ undergraduate students enrolled in 13 asynchronous online courses—including English Composition, U.S. History, and Geology—and found that students who successfully completed the courses accessed significantly more content pages, read and wrote more discussion posts, and spent more time on task ($p < .001$). These behavioral metrics collectively accounted for 31% of the variance in final grades ($R^2 = .31$, $p < .001$), underscoring the predictive value of observable learning activities in online higher education settings.

However, findings regarding the predictive power of behavioral engagement remain inconsistent. In an online undergraduate psychology course with $N = 524$ participants, behavioral indicators alone did not significantly predict final grades ($\beta = .07$, $p = .13$). A significant relationship emerged only when cognitive and emotional engagement were included, with the combined model explaining 10.6% of the variance in academic achievement ($R^2 = .106$, $p < .001$) (Dunn & Kennedy, 2019). Moreover, the meta-analytic findings by Doo and Kim (2024) did not reveal any statistically significant differences in effect sizes across the different engagement dimensions – behavioral, cognitive, emotional, and overall engagement – in relation to learning outcomes in the context of higher education. In the context of

mathematics-focused online courses, a large-scale analysis of three MOOCs in Algebra and Precalculus (N = 71,457) revealed that behavioral engagement, while generally a strong positive predictor of course grades, exhibited considerable variation in its strength and direction across distinct learner subgroups (Li & Baker, 2018). Using interaction log data from the first five weeks of each course, participants were clustered into four behaviorally defined groups: disengagers, auditors, quiz-takers, and all-rounders. The authors demonstrated that increased lecture consumption was positively related to performance among all-rounders (β = .546, p < .001) but negatively associated with course grades among quiz-takers (β = −0.197, p < .001). Consequently, they emphasize the importance of examining subgroup differences to gain a more nuanced understanding of how various forms of engagement relate to learning outcomes (Li & Baker, 2018). Doo and Kim (2024) also highlight the importance of collecting additional learner characteristics to enable more differentiated analyses of participants in online learning environments within higher education.

With regard to secondary education, to the best of our knowledge, only one study has examined the relationship between academic performance and online learning engagement. As part of the development of a measurement instrument, the relationship between engagement (and disengagement) and academic performance among secondary school students (N = 410) in technology-enhanced learning environments was investigated. Low-performing students engaged more frequently in off-task behaviors—such as multitasking and using social media for non-learning purposes—which were both negatively correlated with academic achievement (multitasking: r = –0.19, p < .01; social media: r = –0.15, p < .001). In contrast, high-achieving students demonstrated significantly greater engagement in digital classroom settings compared to their lower-performing peers (r = 0.34, p < .001) (Bergdahl et al., 2020).

In summary, while research on the relationship between academic achievement and student engagement in digital learning environments is scarce in the context of secondary education, studies in higher education have consistently found positive associations with overall student

engagement. However, findings regarding the specific effects of behavioral engagement on academic performance remain inconclusive. Consequently, several researchers advocate for the consideration of subgroup differences to achieve a more differentiated understanding of how different types of engagement are associated with learning outcomes.

Engagement types

Despite the initially apparent diversity in participants' individual engagement behaviors in online learning settings, previous research has revealed a consistent pattern: the wide range of observed activities can be systematically grouped into a few clearly distinguishable learner types (e.g., Anderson et al., 2014; Arora et al., 2017; Chen et al., 2016; Khalil & Ebner, 2017; Kizilcec et al., 2013). By analyzing participants' interactions with lecture content and assessments, four frequently occurring subgroups have been identified (e.g., Kizilcec et al., 2013; Li & Baker, 2018):

Auditors/Viewers: This group is characterized by frequent engagement with lecture videos and auditory or visual materials, while showing little to no participation in course assessments (e.g., Anderson et al., 2014; Chen et al., 2016; Kizilcec et al., 2013; Li & Baker, 2018).

Quiz-Takers: In contrast, Quiz-Takers primarily engage by completing assessments, with limited or no interaction with video lectures or multimedia content (e.g., Anderson et al., 2014; Chen et al., 2016; Kizilcec et al., 2013; Li & Baker, 2018). In the literature, they are also referred to as the "Completing" group (Kizilcec et al., 2013) or "Solvers" (Anderson et al., 2014).

All-Rounders: These learners actively engage with both lecture videos and course assessments (e.g., Anderson et al., 2014; Chen et al., 2016; Kizilcec et al., 2013; Li & Baker, 2018). Their behavior most closely resembles that of students in traditional learning environments (Li & Baker, 2018).

Disengagers: This group shows the lowest level of engagement in online environments, rarely interacting with either assessments or lecture materials (e.g., Anderson et al., 2014; Chen et al., 2016; Kizilcec et al., 2013; Li & Baker, 2018). They are sometimes referred to as "Bystanders" (Anderson et al., 2014).

The relationship between participants' engagement types in online learning environments and their academic performance has been addressed only marginally in the existing literature. Based on behavioral (e.g., quiz and lecture coverage) and cognitive engagement indicators (e.g., pausing, backward seeking, slow watching) collected during the first five weeks of the course, the study of Li & Baker (2018) examined their predictive value for two learning outcomes: final course grade and overall lecture coverage. The results showed that the relationship between engagement and achievement varied significantly across subgroups. For all-rounders, both behavioral indicators—quiz and lecture engagement—were positively associated with course grades (quiz coverage: $\beta = 0.389$, $p < .001$; lecture coverage β: = 0.546, $p < .001$). In comparison, among quiz-takers, course grade was strongly predicted by quiz engagement ($\beta = 1.15$, $p < .001$), but negatively related to lecture engagement ($\beta = –0.197$, $p < .001$).

In another large-scale study on open online courses, various types of learner engagement were identified, which were associated with course completion and certificate attainment (Anderson et al., 2014). These groups differed significantly in their learning outcomes: the likelihood of certification was highest among the All-rounders, who actively engaged with both video content and assignments and achieved high grades. The Quiz-Takers (referred to here as Solvers) also performed well academically but had a slightly lower certification rate than the All-rounders. Viewers rarely obtained certificates. Disengagers (here referred to as Collectors) also exhibited low completion rates.

While existing studies have shed light on the relationship between engagement types and learning outcomes, they are largely confined to higher education and often based on open, self-

directed learning environments. In contrast, digital platforms used in secondary education—such as the one examined in this study—are typically embedded in the formal curriculum and used within more structured learning contexts. Furthermore, we know little about whether established engagement profiles also apply to younger students or how these patterns relate to subject-specific performance in school settings. Addressing this gap, the present study explores engagement types among secondary school learners using a platform for economics education, aiming to extend prior research by examining the predictive value of differentiated engagement patterns in an authentic, school-based learning environment.

Specific RQs

Student engagement is widely recognized as a well-established predictor of academic success in digital learning environments. Numerous empirical studies have demonstrated that higher levels of engagement are associated with improved learning outcomes (e.g., Crossley et al., 2016; Dunn & Kennedy, 2019), underscoring the importance of examining the relationship between engagement and academic performance. However, empirical evidence on this relationship remains scarce in the context of secondary education. Therefore, this study focuses on secondary school students to address the research question:

> RQ1: To what extent is learner engagement with the digital learning environment associated with learning outcomes?

Behavioral engagement in digital learning environments is increasingly captured through log data, such as page views, task completion, or participation in discussion forums. While these observable behavioral indicators often show positive associations with academic performance, their explanatory power varies considerably depending on the learning context and the characteristics of the learner population (Doo & Kim, 2024). Against this backdrop, it becomes essential to examine in greater detail how different patterns of learner behavior in digital

learning environments relate to learning outcomes. Accordingly, the study focuses on the second research question:

> RQ2: How do different patterns of learner behavior in the digital learning environment relate to learning outcomes?

In addition to analyzing individual behavioral data, recent research increasingly focuses on identifying typical engagement types—such as "All-rounders," "Quiz-Takers," "Viewers," or "Disengagers"—based on learners' use of course content and performance on assessments. These groups differ not only in their behavioral patterns but also significantly in their academic outcomes, suggesting that it is not merely the level, but also the nature of engagement that matters. As there is a lack of empirical evidence on these engagement types in secondary education, it is particularly important to examine how they relate to learning outcomes in this context. This study therefore addresses the third research question:

> RQ3: Which relations can be identified between different engagement types and learning outcomes?

Methods

Context

This study was situated within the subject of Economics in southwest Germany which is part of the regular curriculum and is normally allocated two teaching hours per week. The implementation included two cohorts during the 2023/2024 school year, each over a period of 16 weeks. Students were provided with access to the digital learning environment *Wi.Fo!–Lab*, which was developed by an Institute for Economic Education to support curricular learning through interactive and modular content. The digital learning environment consists of 14 thematic modules, of which three—focusing on consumer behavior, data management, and the sharing economy—are specifically designed for and aligned with the Grade 8 curriculum

(Koch, 2022). Within the environment, each module offers a variety of media that can be accessed independent of one another, including videos, audio recordings, statistics, digital books (including texts), caricatures, training tasks (different task types), interactive position lines, collaborative tools such as Spacedeck (a digital whiteboard) and Etherpad (an online text editor), as well as a messaging function (see Table 23 & 24 in the appendix).

As part of the platform's introduction, participating teachers attended a professional development event followed by an initial implementation workshop. Participation in the program was voluntary; teachers registered on their own initiative and had the autonomy to decide how and to what extent they incorporated the digital learning environment into their teaching. Designed to complement regular instruction, the environment could be used flexibly—for example, during individual study time, in whole-class settings, or in group work—according to the teacher's decision. Within the learning environment, students are also granted a high degree of autonomy. The content of the modules can be completed independently of one another. Learners may choose for themselves—or receive guidance from the teacher—in which order they engage with different media and tasks, as well as to which extent they do so.

Participants

The study was carried out in 12 secondary schools located in southwest Germany. Data was collected from a total of $N = 288$ students out of 19 classes across 12 schools (see Table 13). All participants were enrolled in the 8^{th}grade, with a mean age of 13.3 (SD = 0.5) years. Consent to participate was obtained from both students and their legal guardians in advance. Ethical approval for the study was granted by the Ethics Committee of the University (Reference No. A2.5.4-257_bi) and the Regional Council of the District (Reference No. RPT0700-6499-4/2/3).

Table 13

Demographic statistics of sample students

	Participants	
	N	*%*
Total sample	-	-
Female	181	63.9
Male	102	36.1
German native speaker (1/0)	284	99.0
>25 books at home (1/0)	262	91.0
Mother has university degree	126	56.2
Father has university degree	120	56.3
	Mean	*SD*
Age (in years)	13.260	0.520
Math grade (1-6)	2.309	0.980
German grade (1-6)	2.359	0.869

Measures

As part of this study, we collected data on students' performance as well as their engagement and behavior within the digital learning environment.

Performance data were gathered via an online survey using the platform "SoSciSurvey". Students completed questionnaires at two measurement points: prior to the introduction of the learning environment (t_0) and after 16 weeks of engagement with the environment (t_1). The data collection was primarily based on a standardized questionnaire. As dependent variables, a curriculum-based competence test (Oberrauch & Seeber, 2021) and self-developed items aimed at capturing potential knowledge gains related to the specific content of the environment were employed. Table 18 in the appendix provides a detailed overview of the instruments used, including their sources, the number of items per construct, and internal consistency values (Cronbach's alpha). Prior to using the environment, additional control variables were collected, including demographic information, economic interest, cognitive abilities, personality traits,

individual preferences, and normative attitudes (see Table 19 in the appendix). All data were collected anonymously using personal identification codes, allowing for the linkage of responses across measurement points while ensuring participant confidentiality. The data collection was conducted during regular classroom sessions under the supervision of the respective teachers. For the first cohort, measurements took place in October 2023 and February 2024, and for the second cohort, in February 2024 and July 2024 respectively. The data from both cohorts were analyzed jointly.

Engagement was assessed using learning analytics data collected throughout the entire course. These data included the number of login clicks and the number of clicks on individual modules. **Behavioral data**, similar to the approach used by De Barba et al. (2020), were also based on learning analytics and comprised the number of clicks on different media types within the modules. As no timestamps were recorded, media type served as the primary basis for analyzing session behavior.

Based on media use, learners were categorized into four subgroups. In previous studies, the two central academic activities—watching videos and completing assignments—have commonly been used to characterize patterns of engagement (Anderson et al., 2014; Chen et al., 2016; Li & Baker, 2018). Following this approach, we assigned the various media types to these two core activity categories and constructed three indicators: audio/visual engagement (i.e., the proportion of media used that were auditory or visual), quiz engagement (i.e., the proportion of media involving task completion), and the quiz-to-audio/visual ratio (i.e., the ratio of quiz engagement to audio/visual engagement). These indicators were used to classify participants into the respective learner groups.

In line with Li and Baker (2018), this approach resulted in four learner groups: *Disengagers*, *Auditors/Viewers*, *Quiz-takers*, and *All-rounders*. As the existing literature does not provide standardized operational definitions for these subgroups, we defined threshold values for

audio/visual engagement (AV) and quiz engagement (Q) based on the respective sample means across all participants. Learners were classified as follows:

- Disengagers if $AV < M(AV)$ and $Q < M(Q)$
- Auditors/Viewers if $AV > M(AV)$ and $Q < M(Q)$
- Quiz-takers if $Q > M(Q)$ and $AV < M(AV)$
- All-rounders if $AV > M(AV)$ and $Q > M(Q)$

The learning analytics data were linked to responses from student questionnaires, allowing for a comprehensive integration of behavioral and performance measures. Table 14 presents descriptive statistics for each engagement type across various outcome variables.

Table 14

Descriptive statistics of engagement types

	Full sample		All-rounders		Auditors/ Viewers		Quiz-takers		Disengagers	
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
Overall clicks	25.441	21.118	50.812	19.843	25.762	8.467	26.410	8.687	9.055	6.570
Quiz engagement	2.534	2.411	5.115	2.582	1.586	0.606	3.769	1.300	0.843	0.737
Audio/visual engagement	2.139	1.962	4.225	2.011	3.157	1.227	1.087	0.578	0.811	0.642
Economic Competence	5.089	1.985	6.513	1.532	5.262	1.578	5.231	1.813	4.091	1.841
Economic Knowledge	4.688	2.511	5.862	2.359	4.690	2.247	4.692	2.764	3.945	2.345
Digital Media Competence	3.768	0.898	4.076	0.690	3.705	1.059	3.682	0.903	3.597	0.924
Intrinsic Motivation	3.296	0.888	3.537	0.768	3.255	0.982	3.236	0.855	3.178	0.921
Normative Attitudes	2.512	0.419	2.605	0.347	2.540	0.456	2.504	0.358	2.444	0.458

Statistical analysis

To address the first research question, multilevel regression models were employed to examine the impact of contextual variables on individual learning outcomes (Raudenbush & Bryk,

2010). Learner engagement was operationalized using the total number of clicks across the platform and served as the main predictor variable.

For the second research question, additional multilevel models were estimated to analyze learner behavior within the digital environment, specifically focusing on the usage patterns of different media types while accounting for the hierarchical data structure. All models controlled for students' socioeconomic status (SES), gender[6], prior academic performance in German and mathematics, economic interest, cognitive abilities, personality traits, individual preferences, and normative attitudes. To address the third research question, Welch's analyses of variance (ANOVA) were conducted to assess statistically significant differences in learning outcomes across distinct engagement types, accounting for unequal variances and group sizes.

To ensure valid statistical inference, missing data were addressed using Multiple Imputation under the Missing Completely at Random (MCAR) assumption (Graham, 2009). Prior to imputation, Little's test was conducted to assess the MCAR assumption and examine potential links between missingness and learner or classroom characteristics.

Results

RQ1 – Influence of engagement on learning outcomes

To examine the influence of learner engagement in a digital environment on student outcomes, multilevel regression models were estimated using the number of clicks as the sole predictor, while controlling for students' socioeconomic status (ses), gender, prior school performance (German & Math), economic interest, cognitive abilities, personality traits, individual preferences, and normative attitudes.

The analysis showed a statistically significant but small positive association between overall learner engagement, operationalized via click counts, and the development of economic

[6] We use the term *gender* to refer to socially constructed roles, behaviors, and identities of women, men, and gender-diverse individuals, situated within specific historical and cultural contexts.

competence ($\hat{\beta}$ = 0.023, *SE* = 0.008, $p < 0.01$). This relationship remained stable across all model specifications, indicating a robust connection between engagement and the development of economic competence. The ICC indicates that 13.7% of the total variance in economic competence development can be attributed to differences between classes, suggesting a meaningful degree of class-level influence (see Table 15).

With regard to economic knowledge, the analysis also revealed a small, statistically significant relationship with digital learner engagement ($\hat{\beta}$= 0.025, *SE* = 0.007, $p < .01$). Although the coefficient slightly decreased as additional control variables were included, it remained statistically significant across all model specifications, indicating a stable relationship. The overall variance in economic knowledge appears to be less strongly attributable to differences between classes (ICC = 0.093) (see Table 16).

Table 15

Multilevel regression results predicting economic competence development based on learner engagement

Fixed effect	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Number of clicks	0.026*** (0.007)	0.026*** (0.007)	0.026*** (0.007)	0.026*** (0.007)	0.026*** (0.007)	0.025*** (0.007)	0.025** (0.008)	0.024** (0.008)	0.023** (0.008)	0.023** (0.008)
SES		-0.408 (0.615)	-0.420 (0.613)	-0.377 (0.618)	-0.385 (0.619)	-0.426 (0.625)	-0.564 (0.666)	-0.664 (0.673)	-0.529 (0.691)	-0.533 (0.691)
Female			0.515 (0.313)	0.502 (0.327)	0.475 (0.334)	0.555 (0.345)	0.525 (0.371)	0.473 (0.371)	0.557 (0.390)	0.556 (0.391)
German performance				0.074 (0.173)	0.120 (0.209)	-0.119 (0.212)	-0.172 (0.226)	-0.163 (0.226)	-0.184 (0.230)	-0.212 (0.231)
Math performance					0.072 (0.184)	0.027 (0.187)	-0.003 (0.204)	-0.006 (0.205)	0.002 (0.207)	0.033 (0.209)
Economic interest						-0.132 (0.188)	-0.063 (0.199)	-0.070 (0.199)	-0.029 (0.205)	-0.027 (0.206)
Cognitive abilities							0.096 (0.203)	0.115 (0.204)	0.065 (0.207)	0.081 (0.208)
Preferences								-0.020 (0.327)	-0.084 (0.330)	-0.107 (0.332)
Personality									-0.399 (0.385)	-0.336 (0.391)
Normative attitudes										-0.424 (0.419)
N	285	285	285	285	284	277	251	249	243	242
R^2 (marginal)	0.047	0.048	0.056	0.056	0.056	0.060	0.062	0.061	0.057	0.058
R^2 (conditional)	0.194	0.196	0.203	0.202	0.202	0.202	0.208	0.195	0.186	0.187
ICC	0.155	0.155	0.156	0.154	0.154	0.151	0.156	0.142	0.136	0.137

Note. $N = 285$ students in 22 classes; ICC = intraclass correlation coefficient, i.e., proportion of between-class variance. Marginal R^2 = variance explained by fixed effects; Conditional R^2 = variance explained by fixed and random effects. Statistically significant results at $p = .001$ are marked ***. Analyses conducted in R (version 4.4.2) using the *lme4* and *performance* packages.

Table 16

Multilevel regression results predicting economic knowledge based on learner engagement

Fixed effect	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Number of clicks	0.034*** (0.007)	0.033*** (0.007)	0.033*** (0.007)	0.030*** (0.007)	0.028*** (0.007)	0.027*** (0.007)	0.025** (0.007)	0.024** (0.007)	0.026*** (0.008)	0.025** (0.007)
Ses		0.286 (0.626)	0.280 (0.627)	0.155 (0.628)	0.214 (0.618)	0.496 (0.617)	0.556 (0.660)	0.431 (0.665)	0.207 (0.680)	0.144 (0.669)
Female			0.237 (0.320)	0.043 (0.332)	0.252 (0.334)	0.308 (0.341)	0.158 (0.367)	0.171 (0.366)	0.286 (0.384)	0.228 (0.378)
German performance				0.357* (0.176)	0.003 (0.209)	0.066 (0.209)	-0.004 (0.224)	0.005 (0.223)	-0.035 (0.226)	-0.024 (0.223)
Math performance					0.556** (0.183)	-0.599** (0.185)	-0.486* (0.202)	-0.499* (0.202)	-0.504* (0.204)	-0.449* (0.202)
Economic interest						0.226 (0.185)	0.132 (0.197)	0.115 (0.197)	0.173 (0.202)	0.207 (0.199)
Cognitive abilities							0.399* (0.201)	0.396 (0.201)	0.388 (0.204)	0.360 (0.201)
Preferences								-0.444 (0.323)	-0.444 (0.325)	-0.562 (0.322)
Personality									-0.216 (0.379)	-0.353 (0.378)
Normative attitudes										0.759 (0.406)
N	285	285	285	284	284	277	251	249	243	242
R^2 (marginal)	0.080	0.080	0.082	0.091	0.115	0.120	0.122	0.131	0.143	0.148
R^2 (conditional)	0.153	0.153	0.154	0.167	0.195	0.205	0.203	0.209	0.221	0.228
ICC	0.079	0.079	0.079	0.083	0.090	0.097	0.093	0.089	0.091	0.093

Note. $N = 285$ students in 22 classes; ICC = intraclass correlation coefficient, i.e., proportion of between-class variance. Marginal R^2 = variance explained by fixed effects; Conditional R^2 = variance explained by fixed and random effects. Statistically significant results at $p = .001$ are marked ***. Analyses conducted in R (version 4.4.2) using the *lme4* and *performance* packages.

Overall, higher learner engagement—measured by the number of clicks—was consistently associated with greater economic competence development and increased economic knowledge. Although the strength of the association was small compared to other studies, it remained statistically significant across all model specifications, underscoring the robustness of the findings. Class-level differences accounted for a substantial proportion of the variance in economic competence development but played a less prominent role in explaining economic knowledge.

RQ2 – Learner behavior and learning outcomes

Learner behavior was operationalized through engagement with specific task types to investigate their differential relationship with student outcomes (see above).

The use of *Caricatures* ($\beta = 0.22$, $p = .022$), *Trainings* ($\beta = 0.16$, $p = .05$), and *Spacedeck* ($\beta = 0.21$, $p = .011$), was significantly associated with higher levels of economic competence development. These patterns suggest that visual and interactive media formats tend to co-occur with stronger competence outcomes although causal interpretations cannot be drawn. *Etherpad*, a text-based collaboration tool, was significantly associated with sustainability awareness across all model specifications ($\beta = 0.26$, $p = .002$), pointing to a potential role of collaborative reflection in sustainability-related learning (see Table 17).

All other task types—including *Videos*, *Audios*, *Statistics*, *Position lines*, and *Messenger*—did not show significant relations in any of the models. While the association of *Statistics* with sustainability reached marginal significance in the final models, it lacked robustness across model specifications.

These findings remained stable even after controlling for a broad set of learner characteristics. Detailed regression results are provided in Appendix Tables 25 and 26.

Table 17

Multilevel regression results predicting learning outcomes based on engagement with specific media types

	Economic competence			Sustainability		
Predictors	*std. Beta*	*CI*	*p*	*std. Beta*	*CI*	*p*
Videos	0.03	-0.11 – 0.16	0.715	0.08	-0.01 – 0.05	0.295
Audios	-0.16	-0.53 – 0.04	0.095	-0.00	-0.07 – 0.07	0.991
Statistics	-0.07	-0.22 – 0.08	0.367	**-0.16***	**-0.07 – -0.00**	**0.040**
Books	-0.11	-0.16 – 0.03	0.194	0.03	-0.02 – 0.03	0.740
Caricatures	**0.22***	**0.04 – 0.46**	**0.022**	-0.00	-0.05 – 0.05	0.971
Trainings	**0.16***	**0.00 – 0.12**	**0.050**	-0.02	-0.02 – 0.01	0.752
Positionlines	0.15	-0.02 – 0.36	0.084	0.04	-0.03 – 0.05	0.552
Spacedeck	**0.21***	**0.03 – 0.20**	**0.011**	-0.00	-0.02 – 0.02	0.971
Etherpad	-0.02	-0.22 – 0.17	0.826	**0.26****	**0.03 – 0.12**	**0.002**
Messenger	-0.03	-0.38 – 0.26	0.705	-0.15	-0.15 – 0.01	0.076
SES	-0.05	-1.93 – 0.80	0.416	0.11	-0.04 – 0.65	0.080
Female	0.08	-0.31 – 1.27	0.230	0.10	-0.05 – 0.35	0.138
Math performance	-0.07	-0.66 – 0.24	0.355	0.08	-0.05 – 0.17	0.310
German performance	-0.01	-0.43 – 0.38	0.893	**-0.24****	**-0.27 – -0.07**	**0.001**
Economic interest	-0.00	-0.42 – 0.39	0.956	**0.14***	**0.01 – 0.21**	**0.028**
Cognitive abilities	0.01	-0.38 – 0.45	0.859	0.03	-0.08 – 0.13	0.656
Preferences	-0.00	-0.66 – 0.64	0.969	-0.01	-0.18 – 0.15	0.832
Personality	-0.04	-1.04 – 0.51	0.502	**0.27**	**0.21 – 0.60**	**<0.001**
Normative attitudes	-0.07	-1.27 – 0.37	0.282	0.01	-0.18 – 0.23	0.823
Random Effects						
σ^2	5.06			0.32		
$\tau_{00\ cluster}$	1.01			0.00		
ICC	0.17			0.01		
$N_{\ cluster}$	20			20		
Observations	243			242		
Marginal R^2 / Conditional R^2	0.117 / 0.263			0.227 / 0.239		

Note. *N* = 243 students in 22 classes; ICC = intraclass correlation coefficient, i.e., proportion of between-class variance. Marginal R^2 = variance explained by fixed effects; Conditional R^2 = variance explained by fixed and random effects. Statistically significant results at *p* = .001 are marked ***. Analyses conducted in R (version 4.4.2) using the *lme4* and *performance* packages.

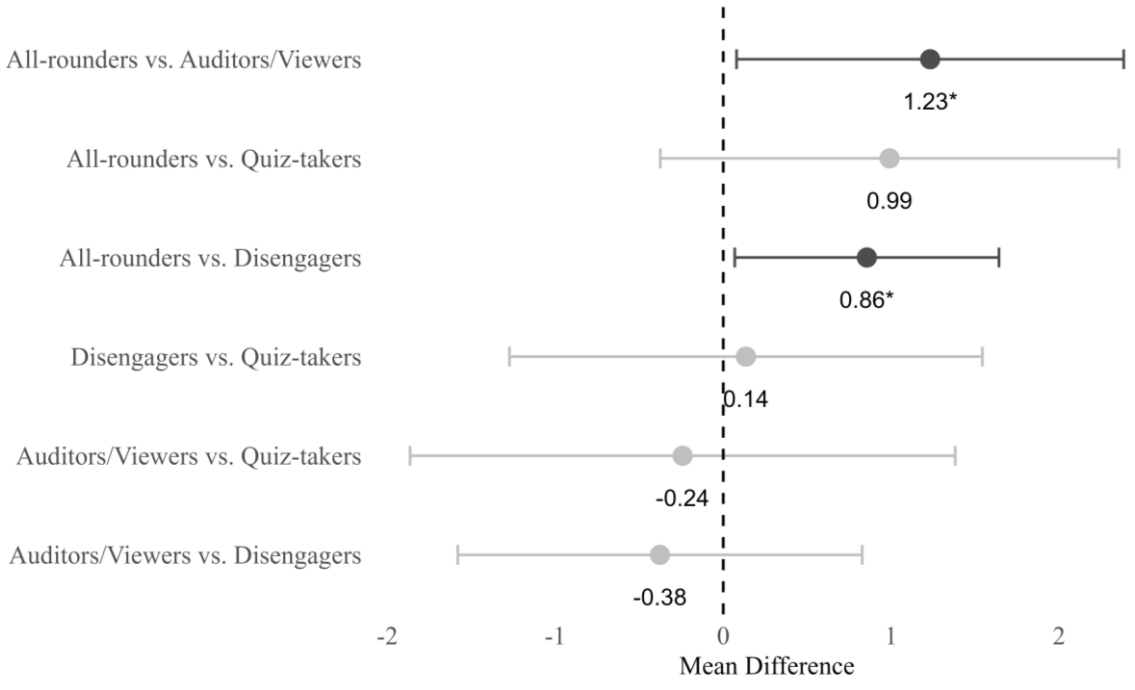
RQ3 – Variation in learning outcomes across engagement types

As shown in the literature, distinct learner profiles can be identified in digital learning environments, which may influence how students engage with content and benefit from instructional interventions. To investigate how different learner profiles relate to learning outcomes, Welch's ANOVAs with Games-Howell post hoc comparisons were conducted for economic competence development, economic knowledge, and digital media competence.

Across all three outcomes, all-rounders consistently outperformed at least one other group, with particularly large and statistically significant differences observed when compared to auditors/viewers and disengagers. Specifically, for the development of economic competence, all-rounders showed significantly higher scores than both auditors/viewers (*mean difference* = 1.23, $p < .05$) and disengagers (*mean difference* = 0.86, $p < .05$), with a substantial trend also in comparison to quiz-takers (0.99), though not statistically significant (see Figure 8).

Figure 8

Estimated pairwise differences in economic competence development by learner profile

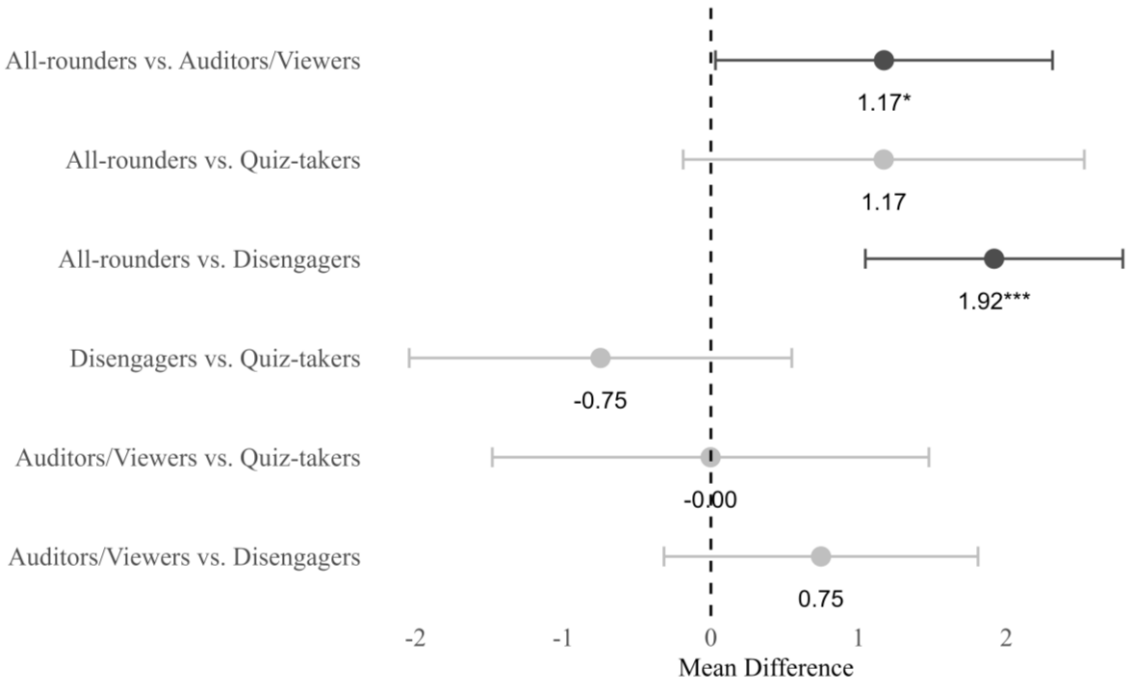


Note. The figure displays pairwise mean differences in economic competence across learner profiles based on Games-Howell post hoc tests following Welch's ANOVA. Error bars represent 95% confidence intervals. Asterisks (*) indicate statistically significant differences at $p < .05$. The reference group in each comparison is listed second.

A similar pattern was observed for economic knowledge, where all-rounders again performed significantly better than auditors/viewers (1.17, $p < .05$) and disengagers (1.92, $p < .001$). The difference to quiz-takers (1.17) was numerically identical but not statistically significant. This suggests that all-rounders consistently benefit more from the learning environment across purely economic measures (see Figure 9).

Figure 9

Estimated pairwise differences in economic knowledge by learner profile

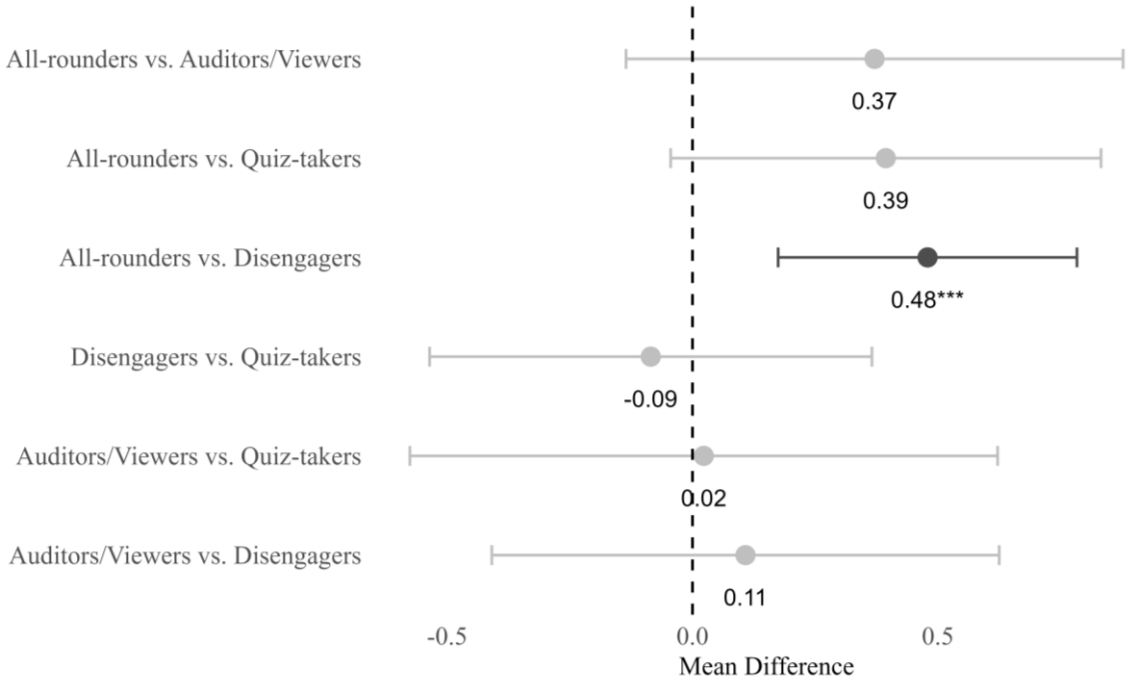


Note. The figure displays pairwise mean differences in economic knowledge across learner profiles based on Games-Howell post hoc tests following Welch's ANOVA. Error bars represent 95% confidence intervals. Asterisks (*) indicate statistically significant differences at $p < .05$. The reference group in each comparison is listed second.

In contrast, differences regarding digital media competence were smaller overall, though still statistically significant between all-rounders and disengagers (*mean difference* = 0.48, $p < .001$). Differences between other groups were not statistically significant, indicating that learner profile has a weaker relationship with digital media competence compared to content knowledge (see Figure 10).

Figure 10

Estimated pairwise differences in digital media competence by learner profile



Note. The figure displays pairwise mean differences in digital media competence across learner profiles based on Games-Howell post hoc tests following Welch's ANOVA. Error bars represent 95% confidence intervals. Asterisks (*) indicate statistically significant differences at $p < .05$. The reference group in each comparison is listed second.

Taken together, the results highlight that all-rounders—students who actively engage across multiple activity types—consistently show higher learning outcomes, particularly in purely economic domains. Differences between other learner types (e.g., auditors vs. quiz-takers) were generally small and statistically non-significant across all three outcomes.

Discussion

This study examined how secondary school students engage with a digital learning platform embedded in the economics curriculum and how different patterns of engagement relate to learning outcomes. Using log data from 285 students, we found that higher levels of behavioral engagement—measured using learning analytics data in the form of total platform interactions—were consistently associated with greater development of economic competence and knowledge. Although the effect estimates were modest in comparison to other studies (e.g., Bergdahl et al., 2020; Li & Baker, 2018), they remained stable across model specifications, underscoring the robustness of the observed associations. Accordingly, with regard to RQ1, it can be concluded that the overall level of learner engagement is positively correlated with learning outcomes. Our study thus confirms the association between behavioral engagement and learning outcomes which have also been observed in other disciplinary contexts—for example, in the field of biology (De Barba et al., 2020; Jiang et al., 2014) and in computational linguistics (Crossley et al., 2016).

Importantly, we identified significant differences in learning outcomes based on the types of activities students engaged with. Interactive and visual formats such as Caricatures, Trainings, and Spacedeck were associated with economic competence development. These specific media formats are particularly visually appealing and interactively structured, consequently, they may encourage more intensive engagement with the content and thereby promote deeper cognitive processing. This finding is in line with instructional design theories highlighting that the design of digital learning environments constitutes a central factor for their effectiveness (Faustmann et al., 2019). In comparison, collaborative work on Etherpad showed an association with sustainability awareness—an unexpected finding that, to our knowledge, has not been reported in previous research. One possible explanation could be that the act of rephrasing or documenting content may prompt learners to reflect more deeply on sustainability-related issues, thereby enhancing their awareness. Our results (RQ2) highlight the relationships

between specific learner behaviors in the digital learning environment and learning outcomes, indicating that not only the quantity but also the pattern and quality of engagement are significantly related to what students actually learn.

Finally, learner behavior could be meaningfully clustered into four engagement types—Disengagers, Viewers, Quiz-Takers, and All-Rounders—replicating previous research in higher education (Li & Baker, 2018). Students who showed balanced engagement across content and assessments (All-Rounders) achieved the strongest learning outcomes, echoing findings from MOOC contexts (e.g., Anderson et al., 2014) and extending them to secondary education. In contrast to previous research in this area (e.g., Khalil & Ebner, 2017; Li & Baker, 2018), our study in the secondary school context does not find a clear association between purely task-based learning and particularly high academic achievement. Li and Baker (2018), for instance, suggest that so-called Quiz-Takers tend to achieve high performance scores because they often possess substantial prior knowledge and therefore skip content, assuming they do not need additional instructional input. This hypothesis could not be confirmed in our study. One possible explanation is that, unlike many MOOC participants, secondary school students tend to have lower levels of prior knowledge and also lower self-regulation skills, which may result in more superficial understanding and reduced performance when content engagement is skipped. Furthermore, we found that All-Rounders also demonstrated higher levels of digital competence, which suggests that a versatile and active pattern of platform use—as observed in this group—may itself contribute to the development of digital skills. With regard to RQ3, it can thus be concluded that different engagement types are associated with specific learning outcomes, with All-Rounders exhibiting the highest levels of competence development and digital skill acquisition.

Overall, our findings highlight the potential of log data to reveal meaningful patterns of learner behavior in digital, school-based learning environments. At the same time, the results emphasize the importance of offering diverse learning formats that move beyond simple task

completion to actively promote deeper cognitive and affective engagement. In line with prior research (e.g., Doo & Kim, 2024; Li & Baker, 2018), we can show a positive association between behavioral engagement and learning outcomes aligns. Additionally, our study is one of the first to show that such patterns are also observable among secondary students using platforms integrated into classroom teaching. The results also underscore the importance of engagement quality. Learners who participated in a diverse set of activities, especially those combining content exploration with self-testing, tended to perform better. This finding is supported by theories suggesting that active, varied engagement may foster deeper understanding and knowledge retention (Anderson et al., 2014). We extend the literature by revealing relationships not only between general patterns of learner behavior but also between specific task types and outcome domains (e.g., Etherpad and sustainability awareness). This suggests that task design and media format are relevant not only for students general engagement, but also for what they take away from the experience. This has implications for instructional design, particularly in hybrid learning contexts where both in-class and self-paced elements are combined.

Conclusion

The present study investigated how secondary school students engage with a digital learning environment in the context of economic education and how different patterns of learner behavior relate to learning outcomes. The findings confirm that both the intensity and the nature of engagement are relevant for competence development, with particularly positive associations observed among students who combined content exploration with task completion. Moreover, the study extends previous research by identifying distinct engagement types in secondary education and demonstrating their differential relationships with learning outcomes, thereby contributing new insights into how digital tools function within real-world school settings.

From these results, some important implications for (digital) classroom instruction in secondary education can be drawn. First, students who engaged with the digital learning environment in diverse ways—by not only consuming content but also actively completing tasks benefited most from the learning environment. Accordingly, deliberately designing digital tools with the goal to support multiple modes of learning and, above all, to systematically encourage active student participation could strengthen the effectiveness of the learning environment. Second, although instructional design of the learning environment is important, the teacher may also influence the effectiveness of the intervention. We observed substantial variation in outcomes between classes, which could reflect differences in how the environment was implemented in practice, including how teachers integrated it into their instruction. While we cannot establish causality, one possible explanation for this variation is a lack of support for teachers. If so, offering targeted training that focuses not only on the technical use of digital environments but also on their pedagogical integration, might help ensure more consistent implementation and outcomes. This would equip educators with strategies for meaningful use of digital tools. Third, the identification of distinct engagement types underscores that digital learning environments are not used by all students equally. This highlights the need for greater individualization as well as guidance within the learning environment—through adaptive learning pathways, targeted feedback, or low-threshold engagement mechanisms tailored to less active learners.

Although the findings contribute meaningfully to the field, certain limitations must be considered. While pre- and post-measurements were available, the absence of a control group limits the ability to draw causal inferences from the observed associations. Future research should explore whether targeted efforts to foster student engagement lead to measurable learning gains in secondary education. Also, the construct of student engagement has itself been subject of critical discussion in the literature (e.g., Trowler et al., 2022) as it encompasses multiple dimensions and may not uniformly reflect meaningful learning processes. Although we have included an intensive set of controls compared to some studies in higher education,

unmeasured factors such as instructional practices may have also influenced the results. A key point in this regard is that teachers retained full autonomy over how the digital platform was integrated—for example, in assigning homework—which introduces variance in implementation (as also visible in our data). While this can be seen as a source of confounding, it also reflects the strength of an authentic, real-world educational setting. Lastly, the log data primarily capture user interactions such as clicks and differentiate between media types, which is beneficial. However, they do not indicate whether the activities occurred during lessons or outside of class. Future research could, for instance, analyze timestamp data to gain more precise insights into when and for how long the learning platform was used.

In light of these limitations, several important research questions remain open. For instance, it is still unclear which factors lead students to develop specific types of engagement in digital learning environments and how stable these engagement types are over time. Individual learner characteristics, as well as instructional design and the broader school context, may play a role in this process. Furthermore, there is a lack of knowledge regarding the differential effects of in-school versus out-of-school use of digital learning environments on student learning outcomes. The substantial variation between classes also suggests that differences in teachers' implementation practices are a key influencing factor. Finally, the question arises as to how digital learning environments can be designed to specifically activate less engaged learners—potentially through adaptive and scaffolded learning paths, motivational prompts, or individualized feedback. Addressing these questions may help to further improve digital educational offerings, by better tailoring them to diverse learner needs. Above all, it is important that they are seamlessly integrated into everyday school practice.

In summary, this study provides important insights into how a digital learning environment is used in an authentic school environment. The associations between different types of learner engagement and students' competence development provide a first indicator that the digital learning environment needs to be used in a comprehensive way to be effective, albeit further

research is needed. Only by understanding the interplay between learner characteristics, the design of the learning environment, and how it is implemented in practice can we develop digital tools that work well for all students.

References

Alrashidi, O., Phan, H. P., & Ngu, B. H. (2016). Academic Engagement: An Overview of Its Definitions, Dimensions, and Major Conceptualisations. *International Education Studies*, *9*(12), 41. https://doi.org/10.5539/ies.v9n12p41

Anderson, A., Huttenlocher, D., Kleinberg, J., & Leskovec, J. (2014). Engaging with massive online courses. In ACM (ed.), *Proceedings of the 23rd International Conference on World Wide Web*, 687–698. https://doi.org/10.1145/2566486.2568042

Appleton, J. J., Christenson, S. L., Kim, D., & Reschly, A. L. (2006). Measuring cognitive and psychological engagement: Validation of the Student Engagement Instrument. *Journal of School Psychology*, *44*(5), 427–445. https://doi.org/10.1016/j.jsp.2006.04.002

Arora, S., Goel, M., Sabitha, A. S., & Mehrotra, D. (2017). Learner Groups in Massive Open Online Courses. *American Journal of Distance Education*, *31*(2), 80–97. https://doi.org/10.1080/08923647.2017.1300461

Barry, D., & Breuer, K. (2012). Die Einstellung zu Geld bei Jugendlichen und jungen Erwachsenen–Entwicklung eines Instruments in deutscher Sprache. In *Forschungscluster „Gesellschaftliche Abhängigkeiten und soziale Netzwerke“: Gesellschaftliche Teilhabe trotz Schulden.* (pp. 9–25). Symposium “Gesellschaftliche Teilhabe trotz Schulden? -- Perspektiven Interdisziplinären Wissenstransfers,” Wiesbaden. Springer VS.

Bergdahl, N. (2022). Engagement and disengagement in online learning. *Computers & Education*, *188*, 104561. https://doi.org/10.1016/j.compedu.2022.104561

Bergdahl, N., Nouri, J., Fors, U., & Knutsson, O. (2020). Engagement, disengagement and performance when learning with technologies in upper secondary school. *Computers & Education*, *149*, 103783. https://doi.org/10.1016/j.compedu.2019.103783

Bolliger, D. U., & Halupa, C. (2018). Online student perceptions of engagement, transactional distance, and outcomes. *Distance Education*, *39*(3), 299–316. https://doi.org/10.1080/01587919.2018.1476845

Chen, S., Huang, C.-C., & Chou, T.-L. (2016). The Effect of Metacognitive Scaffolds on Low Achievers' Laboratory Learning. *International Journal of Science and Mathematics Education*, *14*(2), 281–296. https://doi.org/10.1007/s10763-015-9691-9

Cho, M.-H., & Cho, Y. (2014). Instructor scaffolding for interaction and students' academic engagement in online learning: Mediating role of perceived online class goal structures. *The Internet and Higher Education*, *21*, 25–30. https://doi.org/10.1016/j.iheduc.2013.10.008

Cipriani, G. P., Lubian, D., & Zago, A. (2009). Natural born economists? *Journal of Economic Psychology*, *30*(3), 455–468. https://doi.org/10.1016/j.joep.2008.10.001

Crossley, S., Paquette, L., Dascalu, M., McNamara, D. S., & Baker, R. S. (2016). Combining click-stream data with NLP tools to better understand MOOC completion. *Proceedings of the Sixth International Conference on Learning Analytics & Knowledge*, 6–14. https://doi.org/10.1145/2883851.2883931

Cutumisu, M., Blair, K. P., Chin, D. B., & Schwartz, D. L. (2015). Posterlet: A Game-Based Assessment of Children's Choices to Seek Feedback and to Revise. *Journal of Learning Analytics*, *2*(1). https://doi.org/10.18608/jla.2015.21.4

De Barba, P. G., Malekian, D., Oliveira, E. A., Bailey, J., Ryan, T., & Kennedy, G. (2020). The importance and meaning of session behaviour in a MOOC. *Computers & Education*, *146*, 103772. https://doi.org/10.1016/j.compedu.2019.103772

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. Plenum.

Doo, M. Y., & Kim, J. (2024). The relationship between learning engagement and learning outcomes in online learning in higher education: A meta-analysis study. *Distance Education*, *45*(1), 60–82. https://doi.org/10.1080/01587919.2024.2303484

Dunn, T. J., & Kennedy, M. (2019). Technology Enhanced Learning in higher education; motivations, engagement and academic achievement. *Computers & Education*, *137*, 104–113. https://doi.org/10.1016/j.compedu.2019.04.004

Falk, A., Becker, A., Dohmen, T., Huffman, D., & Sunde, U. (2016). *The Preference Survey Module: A Validated Instrument for Measuring Risk, Time, and Social Preferences.* IZA Discussion Paper 9674.

Faustmann, G., Kirchner, K., Lemke, C., & Monett, D. (2019). Which factors make digital learning platforms successful?. In IATED (Ed.), *13th International Technology, Education and Development Conference* (pp. 6777–6786). https://doi.org/10.21125/inted.2019.1651

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School Engagement: Potential of the Concept, State of the Evidence. *Review of Educational Research*, *74*(1), 59–109. https://doi.org/10.3102/00346543074001059

Fülöp, M., Mihály, B., & Roland-Lévy, C. (2008). Adolescents' Perception and Attitude towards Competition in Economic Life: The Role of Societal Change. Coping with Demands of Social and Economic Change. *XIth Conference of the European Association for Research on Adolescence*.

Gerick, J., & Eickelmann, B. (2017). *Abschlussbericht im Rahmen der wissenschaftlichen Begleitung der Evaluation des Projekts „Lernen mit digitalen Medien" in Schleswig-Holstein.* Universität Hamburg, Universität Paderborn.

Gericke, N., Boeve-de Pauw, J., Berglund, T., & Olsson, D. (2019). The Sustainability Consciousness Questionnaire: The theoretical development and empirical validation of an evaluation instrument for stakeholders working with sustainable development. *Sustainable Development*, *27*(1), 35–49. https://doi.org/10.1002/sd.1859

Gerlitz, J.-Y., & Schupp, J. (2005). *Zur Erhebung der Big-Five-basierten Persönlichkeitsmerkmale im SOEP*. German Institute for Economic Research (DIW Berlin).

Graham, J. W. (2009). Missing Data Analysis: Making It Work in the Real World. *Annual Review of Psychology*, *60*(1), 549–576. https://doi.org/10.1146/annurev.psych.58.110405.085530

Heller, K. A., Kratzmeier, H., & Lengfelder, A. (1998). *Matrizen-Test-Manual Band 1. Ein Handbuch mit deutschen Normen zu den Standard Progressive Matrices von J.C. Raven.* Beltz.

Henrie, C. R., Halverson, L. R., & Graham, C. R. (2015). Measuring student engagement in technology-mediated learning: A review. *Computers & Education*, *90*, 36–53. https://doi.org/10.1016/j.compedu.2015.09.005

Jiang, S., Williams, A. E., Schenke, K., Warschauer, M., & O'Dowd, D. (2014, July 4). *Predicting MOOC performance with Week 1 Behavior*. Educational Data Mining. https://www.semanticscholar.org/paper/Predicting-MOOC-performance-with-Week-1-Behavior-Jiang-Williams/0f2e9943e4d6054a43e2029a8379a420bd8f9899

Kahu, E. R., & Nelson, K. (2018). Student engagement in the educational interface: Understanding the mechanisms of student success. *Higher Education Research & Development*, *37*(1), 58–71. https://doi.org/10.1080/07294360.2017.1344197

Kaiser, T., Oberrauch, L., & Seeber, G. (2020). Measuring economic competence of secondary school students in Germany. *The Journal of Economic Education*, *51*(3–4), 227–242. https://doi.org/10.1080/00220485.2020.1804504

Khalil, M., & Ebner, M. (2017). Clustering patterns of engagement in Massive Open Online Courses (MOOCs): The use of learning analytics to reveal student categories. *Journal of Computing in Higher Education*, *29*(1), 114–132. https://doi.org/10.1007/s12528-016-9126-9

Kizilcec, R. F., Piech, C., & Schneider, E. (2013). Deconstructing disengagement: Analyzing learner subpopulations in massive open online courses. *Proceedings of the Third*

International Conference on Learning Analytics and Knowledge, 170–179. https://doi.org/10.1145/2460296.2460330

Koch, M. (2022, February 22). *Konzeption und Realisierung eines virtuellen Lernraums für die unterrichtliche Auseinandersetzung mit dem Spannungsfeld „Wirtschaft—Ethik—Digitalisierung“* [Vortrag]. Jahrestagung 2022 der Deutschen Gesellschaft für Ökonomische Bildung, Online.

Landis, R. N., & Reschly, A. L. (2013). Reexamining Gifted Underachievement and Dropout Through the Lens of Student Engagement. *Journal for the Education of the Gifted*, *36*(2), 220–249. https://doi.org/10.1177/0162353213480864

Li, Q., & Baker, R. (2018). The different relationships between engagement and outcomes across participant subgroups in Massive Open Online Courses. *Computers & Education*, *127*, 41–65. https://doi.org/10.1016/j.compedu.2018.08.005

Li, S., Yu, C., Hu, J., & Zhong, Y. (2016). Exploring the Effect of Behavioral Engagement on Learning Achievement in Online Learning Environment: Learning Analytics of Non-degree Online Learning Data. *2016 International Conference on Educational Innovation through Technology (EITT)*, 246–250. https://doi.org/10.1109/EITT.2016.56

Macfadyen, L. P., & Dawson, S. (2010). Mining LMS data to develop an “early warning system” for educators: A proof of concept. *Computers & Education*, *54*(2), 588–599. https://doi.org/10.1016/j.compedu.2009.09.008

Masur, P. K., Teutsch, D., & Trepte, S. (2017). Entwicklung und Validierung der Online-Privatheitskompetenzskala (OPLIS). *Diagnostica*, *63*(4), 256–268. https://doi.org/10.1026/0012-1924/a000179

Morris, L. V., Finnegan, C., & Wu, S.-S. (2005). Tracking student behavior, persistence, and achievement in online courses. *The Internet and Higher Education*, *8*(3), 221–231. https://doi.org/10.1016/j.iheduc.2005.06.009

Niehues, J. (2014). Subjektive Ungleichheitswahrnehmung und Umverteilungspräferenzen – ein internationaler Vergleich. *IW Trends*, *2*. https://doi.org/10.2373/1864-810X.14-02-06

Oberrauch, L., & Seeber, G. (2021). The impact of mandatory economic education on adolescents' attitudes. *Education Economics*, *30*(2), 208–224. https://doi.org/10.1080/09645292.2021.1967294

Peart, M. T., Gutiérrez-Esteban, P., & Cubo-Delgado, S. (2020). Development of the digital and socio-civic skills (DIGISOC) questionnaire. *Educational Technology Research and Development*, *68*(6), 3327–3351. https://doi.org/10.1007/s11423-020-09824-y

Pellas, N. (2014). The influence of computer self-efficacy, metacognitive self-regulation and self-esteem on student engagement in online learning programs: Evidence from the virtual world of Second Life. *Computers in Human Behavior*, *35*, 157–170. https://doi.org/10.1016/j.chb.2014.02.048

Peters, L., Shmerling, S., & Karren, R. (2011). Constructivist Pedagogy in Asynchronous Online Education: Examining Proactive Behavior and the Impact on Student Engagement Levels. *International Journal on E-Learning*, *10*(3), 311–330.

Poellhuber, B., Roy, N., & Bouchoucha, I. (2019). Understanding Participant's Behaviour in Massively Open Online Courses. *The International Review of Research in Open and Distributed Learning*, *20*(1). https://doi.org/10.19173/irrodl.v20i1.3709

Raudenbush, S. W., & Bryk, A. S. (2010). *Hierarchical linear models: Applications and data analysis methods* (2nd ed.). Sage Publ.

Rubinstein, A. (2006). A Sceptic's Comment on the Study of Economics. *The Economic Journal*, *116*(510), C1–C9. https://doi.org/10.1111/j.1468-0297.2006.01071.x

Thompson, J. R., Klass, P. H., & Fulk, B. M. (2012). Comparing Online and Face-to-Face Presentation of Course Content in an Introductory Special Education Course. *Teacher Education and Special Education: The Journal of the Teacher Education Division of the*

Council for Exceptional Children, *35*(3), 228–242. https://doi.org/10.1177/0888406412441627

Trowler, V., Allan, R. L., Bryk, J., & Din, R. R. (2022). Pathways to student engagement: Beyond triggers and mechanisms at the engagement interface. *Higher Education*, *84*(4), 761–777. https://doi.org/10.1007/s10734-021-00798-1

Van Rooij, E. C. M., Jansen, E. P. W. A., & Van De Grift, W. J. C. M. (2017). Secondary school students' engagement profiles and their relationship with academic adjustment and achievement in university. *Learning and Individual Differences*, *54*, 9–19. https://doi.org/10.1016/j.lindif.2017.01.004

Vayre, E., & Vonthron, A.-M. (2017). Psychological Engagement of Students in Distance and Online Learning: Effects of Self-Efficacy and Psychosocial Processes. *Journal of Educational Computing Research*, *55*(2), 197–218. https://doi.org/10.1177/0735633116656849

Walstad, W. B., & Soper, J. C. (1983). Measuring Economic Attitudes in High School. *Theory & Research in Social Education*, *11*(1), 41–54. https://doi.org/10.1080/00933104.1983.10505442

Wilde, M., Bätz, K., Kovaleva, A., & Urhahne, D. (2009). Überprüfung einer Kurzskala intrinsischer Motivation (KIM). *Zeitschrift Für Didaktik Der Naturwissenschaften*, *15*, 31–45.

Yamauchi, K. T., & Templer, D. J. (1982). The Development of a Money Attitude Scale. *Journal of Personality Assessment*, *46*(5), 522–528. https://doi.org/10.1207/s15327752jpa4605_14

5. General discussion

Critical thinking in ethical contexts is a key 21st-century competency (Yasa et al., 2024), especially given technological developments that have intensified challenges such as fake news and AI-driven misinformation (Chen et al., 2023). These concerns are reinforced by recurring cases of unethical behavior in political, economic, and even educational settings (Alonso & Schweiger-Gallo, 2022). Consequently, business ethics represents a key interdisciplinary dimension of citizenship education, integrating economic, social, and ethical perspectives and underscoring the need to foster ethical judgment in secondary students (Piller, 2016; Ulrich, 2012). IBL has proven particularly suitable for the teaching of business ethics—especially in its digital implementation (e.g., Bónus et al., 2024)—as it promotes the development of critical–analytical thinking and problem-oriented learning processes (Hermidayani et al., 2019; Iacovidou et al., 2020). Nevertheless, there is still limited empirical evidence on the application of digital IBL in the social sciences. From general educational research, it is already known that four fundamental categories of factors influence the effectiveness of instructional approaches: *student characteristics*, *teacher characteristics*, *context*, and *content* (Hirsh et al., 2022). In digital environments, *student engagement* has been identified as a particularly crucial determinant, which is in turn influenced by *student characteristics*, *teacher characteristics*, and *context* (Al Mamun & Lawrie, 2023; Meyer, 2014; Miles et al., 2018). Although digital learning environments are gaining increasing importance in school settings—for example, by facilitating flexible and interactive learning—empirical findings on their effectiveness in social science education remain scarce.

The aim of this dissertation was, therefore, to address the existing research gap by linking the social science field of business ethics with the pedagogical approach of digitally supported IBL and empirically examining its effectiveness regarding students' competence development. In doing so, this work provides an empirically grounded contribution to the investigation of

approaches that promote business ethical competencies at the secondary school level. Building on the factors identified in the literature as relevant to the effective implementation of digital instructional approaches, this dissertation is guided by three central research questions:

(1) *Which conceptions do students have regarding business ethical issues in the context of secondary education?*

(2) *To what extent does digitally supported, inquiry-based learning foster the development of students' business ethical competencies?*

(3) *How do students' engagement patterns in digital learning environments differ, and how are these patterns related to the development of business ethical competencies?*

To address the research questions, three empirical studies were conducted for this dissertation. The following section summarizes the findings of each study and discusses the main results. The strengths and limitations of the dissertation are then outlined, and implications for future research and educational practice are derived.

5.1 Summary and discussion of the findings

5.1.1 Summary of the findings

The results of Study 1, comprising 33 semi-structured interviews that focused on the factor of student characteristics, indicate that students predominantly reason in a fragmented manner and mainly on an individual-ethical level when reflecting on issues of business ethics. Most responses concerning consumer power and responsibility referred to consumption-related decisions, whereas political activities were mentioned less frequently. Regarding the question of what determines the power and responsibility of consumers, there was broad consensus that collective action by large groups has a much greater influence and carries a higher degree of responsibility within the economic system than individual decisions made by single persons. According to the students' assessments, the extent of power and responsibility also depends on factors such as company size, one's own position, social environment, and age. Moreover,

several misconceptions became evident, particularly concerning the division of responsibilities between the state and companies. These were linked to uncertainties regarding questions of regulatory ethics, a predominantly individual mode of reasoning, and partly fragmented conceptions. Furthermore, misunderstandings emerged concerning the distribution of economic power and the functioning of competition within the economic system.

Study 2 employed a quasi-experimental design to examine the effects of digitally supported IBL on students' business ethical competencies (N = 445), thereby allowing for a combined analysis of the factors of *teacher characteristics* and *context*. No evidence was found for a significant effect of digitally supported IBL on competence development compared to traditional instruction. However, subgroup analyses revealed significant gender-specific differences. In particular, digitally supported IBL led to an increase in economic interest and intrinsic motivation among female students, whereas a decline in economic interest was observed among male students.

The analysis of the overarching factor of *student engagement* (N = 285) within a digital learning environment (Study 3), based on log data, revealed that higher levels of behavioral engagement were consistently associated with significantly greater economic competence development and knowledge gains. Moreover, learning outcomes varied depending on the type of learning activities used. The use of interactive and visually oriented formats—*Caricatures*, *Trainings*, and *Spacedeck*—showed a significant positive relationship with the development of economic competencies. Regarding collaborative work, more frequent use of the *Etherpad feature* was associated with higher levels of sustainability awareness. The classification of students' engagement behavior into four types—*Disengagers*, *Viewers*, *Quiz-Takers*, and *All-Rounders*—indicated that balanced engagement with both content and tasks (*all-rounders*) was linked to the most favorable learning outcomes and a higher level of digital competence.

In summary, the analysis of factors influencing the effectiveness of digitally supported IBL suggests that, in the context of a predominantly individual ethical perspective, the quality of

learning activities and the degree of active, balanced engagement are central to competence development. Additionally, gender-specific differences emerged as a significant factor in shaping learning outcomes. In the following sections, the findings are discussed and then integrated into a specific framework for the effectiveness of digital IBL in secondary social science education to address the overarching research questions of the dissertation.

5.1.2 Student characteristic: Predominant conceptions of business ethics

The interview study (Study 1) extends the research on students' conceptions in the fields of economic and business ethics. Prior work has shown that these are often characterized by one-dimensional judgments (Kaiser et al., 2015) that primarily focus on everyday life (Aprea & Sappa, 2014) and individual consumption (Friebel et al., 2013). As a result, students frequently display an insufficient understanding of the state's role (Lemme & Neuhof, 2014), a lack of awareness of power and exploitation structures (Kleinschmidt et al., 2015), and a limited ability to connect environmental consequences with pricing mechanisms (Ignell et al., 2013). Our research contributes by empirically demonstrating this predominance of individual-level conceptions, thereby offering a curriculum-aligned framework for situating students' ethical reasoning within the broader spectrum of business ethics levels. At the same time, the findings reveal considerable diversity in students' ethical conceptions. Students showed multiperspective reasoning, including awareness of resource conservation, recognition of how individual actions affect other market participants, and an understanding that collective consumer groups are seen as more powerful and responsible than individuals. These findings suggest that students are at least partly aware of the interrelations between individual and institutional ethics, even though they sometimes blur the boundaries between governmental and corporate responsibilities and exhibit a limited understanding of regulatory–ethical contexts. Furthermore, the study revealed, for the first time, a predominantly negative image of larger companies, which may be attributed to a restricted knowledge of corporate ethics.

The central conclusion was that business ethics issues should be addressed from multiple perspectives from the very beginning of economic education rather than following a sequential focus that initially confines instruction to the individual-ethical level. Loerwald (2017) similarly stresses the importance of consciously distinguishing between micro- and macro-perspectives, as well as short- and long-term viewpoints, to foster perspective taking in learning processes. Considering the fragmented conceptions identified in this study as prior knowledge—and thus as student characteristics within the IBL process—highlights the need to scaffold perspective taking and provide explicit perspective guidance early on. Such support enables learners to develop more coherent and interconnected ethical–economic understandings from their initially fragmented conceptions.

To foster the development of students' ethical conceptions and competencies, innovative pedagogical approaches that stimulate critical thinking are required (Nuraini et al., 2021). One such approach is IBL, particularly in its digitally supported form. However, the effectiveness of IBL in secondary social science education has thus far received little empirical attention and therefore constitutes the main focus of Study 2.

5.1.3 Teachers and context: Effectiveness of implementing a digitally supported inquiry-based learning environment on competence development

Study 2 quantitatively examined the effectiveness of digital IBL on students' business ethical competencies in secondary education, thereby extending existing research to a social science context, as most prior evidence originates from the natural sciences. Interdisciplinary studies have consistently demonstrated that digitally implemented IBL exerts multiple positive effects on various learning outcomes, including the enhancement of critical thinking (e.g., Yasa et al., 2024), scientific process skills (e.g., Bónus et al., 2024), problem-solving abilities (e.g., Hwang & Chen, 2017), academic achievement (e.g., Hwang et al., 2013; Zheng et al., 2018), learning engagement and motivation (e.g., Meitriana et al., 2021; Meng & Jumaat, 2024), conceptual

understanding (e.g., Hermansyah et al., 2019), and digital competence (e.g., Yasa et al., 2024). The study contributes to the literature by demonstrating that the effectiveness of digital IBL may vary across disciplines and by highlighting the importance of considering student-specific characteristics when evaluating instructional approaches. The results revealed no evidence of significant overall effects of digitally supported IBL on economic competence development compared to traditional instruction. Given the varying levels of platform usage and previous findings linking higher treatment intensity to improved learning outcomes (Zafra-Gómez et al., 2015) as well as the type and degree of instructional guidance to learning success (Jerrim et al., 2019; Lazonder & Harmsen, 2016), the study suggests that these factors likely contribute to the absence of significant effects.

Moreover, significant gender-specific effects were identified. While female students who used the learning environment demonstrated a significant increase in economic interest and intrinsic motivation, their male counterparts exhibited a significant decline in economic interest. These findings extend prior research, which has not yet identified gender differences in the context of digital IBL within social science education (Kumari et al., 2015). This suggests that the effectiveness of IBL may depend strongly on the disciplinary context and content design. Male learners may benefit more from experimentally and exploratively structured learning processes, as typically found in the natural sciences, whereas topics in economics and ethics may align more closely with the interests and learning preferences of female students.

The central conclusion of the study was that the effectiveness of digital IBL in the social sciences depends largely on the intensity and mode of use, as well as on group-specific learner characteristics. Since both the frequency and quality of use are largely determined by students' individual engagement, Study 3 focused on a more in-depth analysis of this relationship.

5.1.4 Student engagement: Influence of the frequency and type of behavioral engagement as well as the nature of the learning activity

The analysis of log data from secondary school students in regular classroom settings (Study 3) extends the empirical evidence on digital learning engagement to school-based contexts, where research to date has primarily focused on higher education. Engagement in digital learning comprises behavioral, cognitive, and emotional dimensions (Henrie et al., 2015), with behavioral engagement considered the most central component, while the measurement of the other dimensions remains a matter of debate. The positive relationship between behavioral engagement and learning outcomes, repeatedly demonstrated in higher education research (Anderson et al., 2014; De Barba et al., 2020; Jiang et al., 2014; Li & Baker, 2018), was also confirmed in the study within the secondary education context; higher levels of behavioral participation correlated positively with the development of economic competencies and knowledge gains. Consistent with findings from instructional design research, the results also indicate that interactive and visually oriented learning formats are positively associated with competence development (Faustmann et al., 2019). However, this study extends existing research by identifying a positive relationship between collaborative writing activities and higher levels of sustainability awareness. This highlights that learning success depends not primarily on the amount of engagement but rather on the type of learning activities involved.

Moreover, in line with evidence from massive open online course (MOOC) studies (e.g., Anderson et al., 2014; Li & Baker, 2018), the type of engagement also plays a key role. The study confirms, in the secondary education context, that learners who engage in a balanced way with both content and tasks (*all-rounders*) achieve the highest learning outcomes. However, in contrast to earlier findings (e.g., Li & Baker, 2018), task-oriented learners (*quiz-takers*) did not show significantly better performance than *viewers* or *disengagers*.

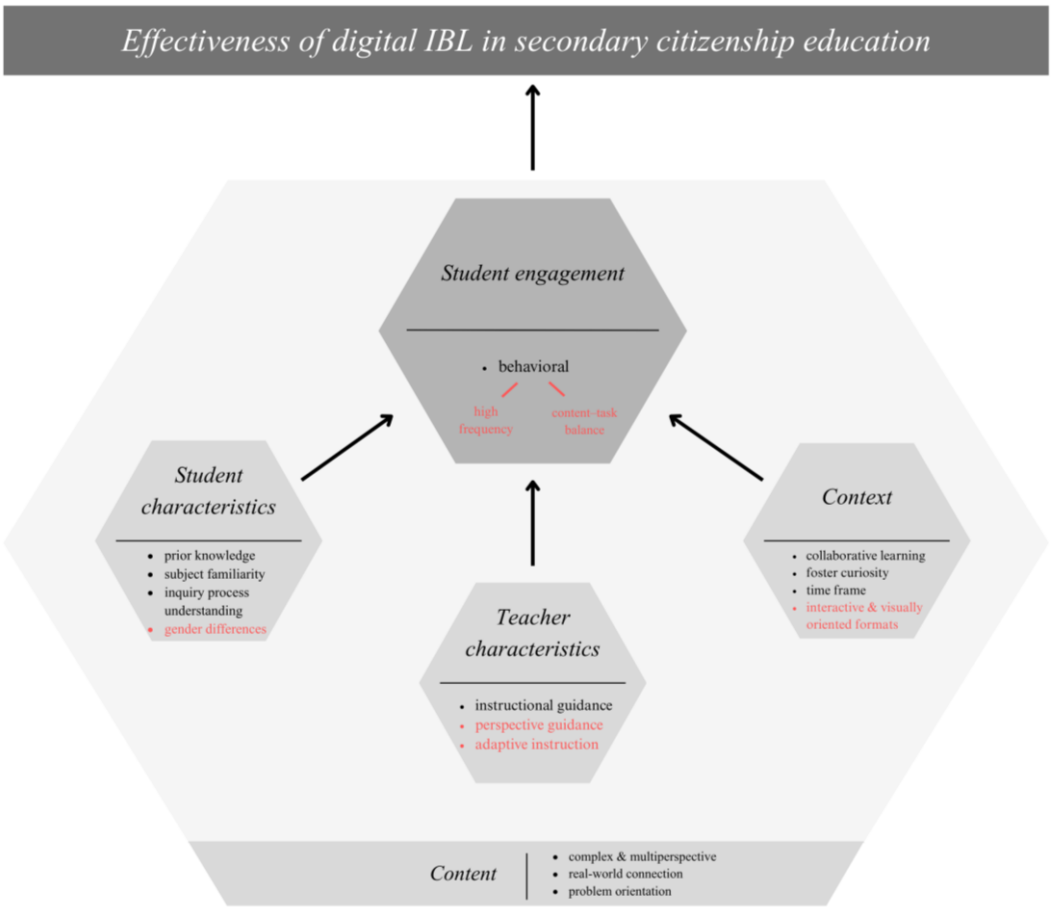
Overall, the study extends existing research by showing that in secondary education, the type of learning activities, as well as the diversity and type of engagement—alongside its quantity—have a significant impact on learning outcomes. Active and versatile engagement promotes deeper understanding and more sustainable knowledge acquisition. Furthermore, the study underscores the central importance of instructional and media design for the effectiveness of digitally supported learning processes.

5.1.5 Conceptual framework for factors influencing the effectiveness of digital inquiry-based learning in secondary citizenship education

To answer the overarching research questions of this dissertation, a conceptual framework for the effectiveness of digital IBL in secondary citizenship education was developed (see Figure 11). This framework builds on the influencing factors of digital teaching identified in the literature and was further expanded by the findings of all three studies. Study 1 highlighted the importance of adopting and critically contrasting multiple perspectives, a process that should ideally be guided by the teacher. Study 2 emphasized the relevance of gender-related differences as key individual preconditions for learning. Study 3 underscored the significance of the frequency of student engagement, the balanced integration of content and task orientation, and the added value of interactive and visual learning formats. As the first subject-specific framework in the field of CE, it has the potential to support teachers in the digital implementation of IBL within social science instruction. Moreover, the framework provides guidance for actors developing digital learning environments, as it identifies and structures the relevant factors for the effective implementation of digital IBL.

Figure 11

Conceptual framework for factors influencing the effectiveness of digital IBL in secondary citizenship education



Note. Content provides the foundation, and four factors—student characteristics, teacher characteristics, context, and student engagement—influence the effectiveness of digital IBL. Student engagement is central. Elements marked in red indicate extensions based on the findings of the three studies conducted in this dissertation.

5.2 Strengths, limitations, and possibilities for future research

One major strength of this dissertation lies in its integration of different strands of research within the field of secondary education. Throughout the work, insights from business ethics education were combined with the pedagogical approach of IBL in the context of digitalization to (1) gain a deeper understanding of eighth-grade students' conceptions of business ethics, (2)

examine the effectiveness of digitally implemented IBL for competence development, and (3) investigate the influence of student engagement in digital learning environments on the development of business ethical competencies. By doing so, this dissertation contributes to bridging the gap between business ethics education, which has predominantly been studied in higher education, and digital IBL, which has mainly been applied in the natural sciences. It responds to the call by Alonso and Schweiger-Gallo (2025) to systematically transfer insights from business ethics research in higher education to the secondary level. Moreover, it is among the first studies to systematically investigate digital IBL in business ethics education at the secondary level in Germany and can therefore serve as a foundation for future research in this important and emerging field.

Another central strength of this dissertation lies in its provision of comprehensive insights into the determinants influencing the effectiveness of digitally implemented instruction. The three substudies each address different aspects of the four key determinants within the context of business ethics education. The theoretically derived determinants, grounded in existing literature, provide a robust conceptual foundation that lends coherence to the overall work and facilitates the integration of individual findings. The resulting framework represents an initial attempt to design a domain-specific model for the field of citizenship education and offers a promising starting point for future research in this area.

Furthermore, this dissertation is strengthened by its application of diverse methodological approaches. The combination of quantitative and qualitative methods made it possible to partially compensate for method-specific limitations—such as the restricted generalizability of qualitative research (Prabhu, 2020)—and to achieve a more holistic understanding of the phenomena under study (Subedi, 2023). The preregistration of the second and third studies[7] contributes to transparency and reproducibility, considering the ongoing replication crisis in the

[7] Due to the exploratory design and the high proportion of open-ended questions, no formal preregistration was conducted for the first study. However, the overall research project was reviewed and approved by both the university's ethics committee and the relevant regional education authority.

social and educational sciences (Wiliam, 2022). Additionally, the interview transcripts from Study 1, as well as the datasets and associated R-code from Studies 2 and 3, will be made publicly available upon request. Despite the use of diverse and rigorous methodological procedures, each study has certain limitations that, at the same time, facilitate the identification of relevant research gaps.

All three studies included only a limited number of students from southwestern Germany. While this increases internal comparability, it limits external validity and, consequently, the generalizability of the findings. For the qualitative interview study (Study 1), this limitation is less critical, as the sample size falls within the recommended range (5–25 interviews) for phenomenological research (Creswell, 1998). However, in Studies 2 and 3, the small sample size constitutes a methodological constraint, as potential effects may have remained undetected due to insufficient statistical power, and the regional focus may have introduced contextual biases. In Study 1, participants were randomly selected within their respective classes; however, background characteristics—such as socioeconomic status—were not systematically collected, despite their well-documented relevance for learning processes and cognitive structures (Tan et al., 2023). Future research should therefore aim to include larger and more heterogeneous samples while systematically gathering background information to enable more nuanced and differentiated analyses.

Although Study 1 emphasized the anonymous processing of data, the potential effects of socially desirable response tendencies cannot be entirely ruled out. Combining interviews with complementary, less reactive methods—such as concept mapping—could reduce this risk in future studies, enhance the validity and reliability of data collection, and provide deeper insights into individual cognitive processes. In light of the absence of overall effects in Study 2, it would be of developmental-psychological interest for future research to investigate how students' business-ethical understanding develops over time, the extent to which more elaborated levels

of reasoning emerge in the ninth and tenth grades, and whether instruction exerts a sustained, long-term influence on students' ethical understanding.

In Studies 2 and 3, the lack of control over how teachers implemented the intervention represents another critical limitation. This resulted in substantial differences in both the intensity and variability of the implementation. Therefore, future studies should ensure more standardized implementation or include fidelity checks to better isolate intervention effects. The focus should be on whether teachers used the environment to guide their students through the inquiry cycle—for example, by supporting them in developing hypotheses, collecting and analyzing data, and drawing conclusions. Moreover, in Study 2, the traditional instruction in the control group was not standardized, leaving it unclear how the comparison lessons were actually conducted. This approach can be interpreted either as a potential confounding factor or as a realistic reflection of everyday school practice. Given the absence of evidence for an overall effect in Study 2, future research should investigate whether an extended model incorporating additional determinants might explain the expected effectiveness of IBL in business ethics education, or whether other variables can be identified that influence its impact. Furthermore, it would be valuable to examine which adaptations in the implementation of IBL are required to support male learners more effectively. Additionally, the role of the teacher and suitable scaffolding strategies should be analyzed in greater depth to ensure the sustainable success of digitally supported IBL approaches.

Considering the finding from Study 3 that higher student engagement correlates with greater competence scores, future research should examine whether targeted interventions to enhance engagement lead to measurable competence gains at the secondary level. In doing so, it is important to recognize that engagement remains a multidimensional construct, and its relationship to actual learning processes continues to be debated (Trowler et al., 2022). To gain more nuanced insights, future studies should collect more detailed behavioral data—for example, through timestamps and contextual information (e.g., whether the learning activity

occurred in class or at home)—to enable a more precise interpretation of engagement and its relation to competence development.

Although the determinants of digital instruction in this dissertation were theoretically derived from the existing literature, not all dimensions of these identified factors could be fully captured. Furthermore, the possible interaction effects between the determinants were not examined, even though such interdependencies may affect instructional processes. Finally, additional, as yet unconsidered variables—such as peer interaction and social dynamics when using the environment or teachers' understanding of business ethics—may also play a role.

Overall, the dissertation—through its strengths and limitations—provides valuable insights and directions for future research on the effectiveness and development of digital IBL in business ethics education.

5.3 Further implications for practice and policy

Beyond the research-related implications, the findings of this dissertation also allow for conclusions regarding the implications for educational practice and education policy. The practice-oriented implications are illustrated in Figure 11, which highlights the red-marked extensions of the model of factors influencing the effectiveness of digital IBL in secondary citizenship education (see Section 5.1.5). By providing a clearer understanding of students' conceptions and misconceptions, this study offers valuable insights into the design of business ethical instruction. These findings may serve as a basis for refining IBL approaches, for instance, by integrating systemic perspectives alongside individual ones and strengthening perspective guidance throughout the inquiry cycle so that students can meaningfully connect ethical reasoning across levels.

The continuous inclusion of multiple perspectives in teaching may help prevent unidimensional beliefs and misconceptions concerning the role of the state. From a pedagogical standpoint, it is essential to systematically account for the heterogeneity of students' conceptions—for

example, through the deliberate use of adaptive teaching strategies (Aprea, 2015). This aspect is also relevant in digital learning environments, given that different types of engagement suggest unequal levels of participation among learners. Consequently, a stronger focus on individualization and targeted support appears necessary. In addition to adaptive learning paths, differentiated feedback and low-threshold activation mechanisms for less active learners could be effective means of fostering participation and learning gains.

With regard to gender-specific learning conditions, IBL materials should be deliberately tailored to diverse learner groups. While this approach may help reduce existing disadvantages for girls in economics education (Haag & Brahm, 2025), further research is needed to understand the mechanisms behind these gender-specific effects. One possible strategy could be to combine IBL with other established instructional approaches, such as game-based learning formats integrated into inquiry-oriented tasks (Hwang et al., 2015).

Regarding the contextual dimension, the findings indicate that interactive and visually oriented formats can lead to greater competence development if they stimulate more intensive engagement with learning content and promote deeper cognitive processing (Faustmann et al., 2019). Consequently, digital learning environments should increasingly incorporate interactive and visually appealing elements to better address and activate learners with diverse backgrounds. This aligns with the findings on student engagement, which suggest that different engagement types—not merely content consumption but also active task processing—are particularly effective for learning. By combining various representational forms, teachers can systematically promote students' active engagement and sustainably support their competence development. Connecting multiple representational forms, however, can also be challenging for learners and may require additional support structures (Scheiter et al., 2017).

In addition to the implications for educational practice, several conclusions can be drawn for education policy. Policy measures in the educational sector should increasingly aim to promote economic, political, and ethical perspectives in an integrated manner. Curricular frameworks

could support teachers in addressing complex societal interrelations at an early stage and across disciplinary boundaries—particularly with regard to the interplay between the market, the state, and the individual. A systematic curricular integration of interactive learning formats into citizenship education could, in the long term, contribute to enhancing critical thinking and sound judgment.

Furthermore, targeted investments in digital infrastructure and adaptive learning technologies are essential to mitigate disparities in learning conditions and ensuring equitable participation. Given that a considerable share of performance differences can be attributed to class- and school-level factors, it appears necessary to develop clear guidelines for the implementation and structural anchoring of digital approaches such as IBL (Voet & De Wever, 2018). At the same time, sustained investment in teacher professionalization is crucial—through continuous training and the systematic integration of relevant content into teacher education programs—to strengthen both the technical use and pedagogical integration of digital learning environments. The objective should extend beyond developing competencies in digital instructional design to include adaptive differentiation and gender-sensitive pedagogy, thereby empowering teachers to employ digital tools in a reflective and pedagogically grounded manner.

5.4 Conclusion

The overarching aim of this dissertation was to integrate business ethical perspectives into digitally supported IBL and systematically examine its effectiveness while considering relevant determinants across three empirical studies. In doing so, it offers a differentiated analysis of the potential and underlying mechanisms of digital IBL within the social sciences at the secondary level and demonstrates that its effectiveness largely depends on the interplay of individual, pedagogical, and contextual factors.

The first study analyzed students' existing conceptions of business ethics within the framework of student characteristics. The second study investigated the effects of digitally implemented

IBL with a focus on business ethics and accounted for both contextual and teacher-related factors (context and teacher characteristics). The third study examined the use of digital learning environments with an emphasis on student engagement and explored the role of active participation in competence development.

By linking digital learning processes with ethically reflective inquiry, this dissertation contributes to promoting students' critical and reflective engagement with economic and societal issues. In doing so, it advances the development of citizenship education in the digital age. This dissertation further advances our understanding of the key determinants shaping successful digital teaching and learning processes at the secondary level. The developed framework represents the first domain-specific, empirically grounded model that systematically explains the effectiveness of digital IBL within the context of CE and, at the same time, offers starting points for future research.

Beyond its scientific contributions, this dissertation yields practice-oriented implications for teacher education, instructional development, and educational policy. It underscores the need to systematically interlink economic, political, and ethical perspectives and provides evidence-based guidance for designing digital learning environments that address gender-related learning differences, pedagogical and contextual conditions, and variations in student engagement. In doing so, it establishes a foundation for targeted professional development initiatives and for the advancement of digital teaching formats aimed at fostering equitable, adaptive, and reflective forms of CE.

Overall, this dissertation constitutes a comprehensive theoretical and empirical investigation of the conditions and underlying mechanisms of digital IBL within the context of business ethics education. It holds substantial relevance for educational research, classroom practice, and education policy, providing a solid foundation for future studies aimed at advancing innovative teaching and learning concepts at the intersection of digitalization, ethics, and economics. Moreover, it advances the understanding of how digital learning environments can enhance

business ethics education and, in the long term, supports the development of learning approaches that foster students' ethical reasoning and sense of responsibility in civic education contexts.

5.5 References

Al Mamun, M. A., & Lawrie, G. (2023). Student-content interactions: Exploring behavioural engagement with self-regulated inquiry-based online learning modules. *Smart Learning Environments*, *10*(1), 1. https://doi.org/10.1186/s40561-022-00221-x

Alonso, M. A., & Schweiger-Gallo, I. (2022). Validación de una escala de conductas éticas en la educación secundaria y superior: La Escala de Ética en Escenarios Educativos (EEEE). *Revista Iberoamericana de Diagnóstico y Evaluación – e Avaliação Psicológica*, *63*(2), 119. https://doi.org/10.21865/RIDEP63.2.09

Alonso, M. A., & Schweiger-Gallo, I. (2025). Ethical behavior intervention through group activities in secondary education. *Psychology in the Schools*, *62*(3), 931–940. https://doi.org/10.1002/pits.23366

Anderson, A., Huttenlocher, D., Kleinberg, J., & Leskovec, J. (2014). Engaging with massive online courses. In ACM (ed.), *Proceedings of the 23rd International Conference on World Wide Web* (pp. 687–698). https://doi.org/10.1145/2566486.2568042

Aprea, C. (2015). Secondary school students' informal conceptions of complex economic phenomena. *International Journal of Educational Research*, *69*, 12–22. https://doi.org/10.1016/j.ijer.2014.09.002

Aprea, C., & Sappa, V. (2014). Variations of young Germans' informal conceptions of financial and economic crises phenomena. *Journal of Social Science Education*, *13*(3), 57–67. https://doi.org/10.4119/jsse-710

Birke, F., Kaminski, H., Koch, M., Langenstein, M., Pinzger, A., & Kaminski-Reuter, O. (2017). *Praxis Wirtschaft Berufs- und Studienorientierung 1*. Westermann.

Bónus, L., Antal, E., & Korom, E. (2024). Digital game-based inquiry learning to improve eighth graders' inquiry skills in biology. *Journal of Science Education and Technology*, *33*, 462–478. https://doi.org/10.1007/s10956-024-10096-x

Bulus, M., Dong, N., Kelcey, B., & Spybrook, J. (2021). *PowerUpR: Power analysis tools for multilevel randomized experiments* (Version 1.1.0) [Computer software]. https://cran.r-project.org/web/packages/PowerUpR/index.html

Chen, K., Shao, A., Burapacheep, J., & Li, Y. (2023). *How GPT-3 responds to different publics on climate change and Black Lives Matter: A critical appraisal of equity in conversational AI*. arXiv:2209.13627.

Creswell, J. W. (1998). *Qualitative inquiry and research design: Choosing among five traditions*. Sage Publications, Inc.

De Barba, P. G., Malekian, D., Oliveira, E. A., Bailey, J., Ryan, T., & Kennedy, G. (2020). The importance and meaning of session behaviour in a MOOC. *Computers & Education*, *146*, 103772. https://doi.org/10.1016/j.compedu.2019.103772

Dong, N., & Maynard, R. (2013). PowerUp!: A tool for calculating minimum detectable effect sizes and minimum required sample sizes for experimental and quasi-experimental design studies. *Journal of Research on Educational Effectiveness*, 6(1), 24–67. https://doi.org/10.1080/19345747.2012.673143

Faustmann, G., Kirchner, K., Lemke, C., & Monett, D. (2019). Which factors make digital learning platforms successful?. In IATED (Ed.), *13th International Technology, Education and Development Conference* (pp. 6777–6786). https://doi.org/10.21125/inted.2019.1651

Friebel, S., Kirchner, V., & Loerwald, D. (2013). Der regionale Wirtschaftsraum als sozialer Aneignungsraum für Schülerinnen und Schüler. *Zeitschrift Für Ökonomische Bildung*, *2*, 42–61. https://doi.org/10.7808/zfoeb.1.2.75

Haag, L., & Brahm, T. (2025). The gender gap in economic and financial literacy: A review and research agenda. *International Journal of Consumer Studies*, *49*(2), e70031. https://doi.org/10.1111/ijcs.70031

Hedtke, R. (2015). Wissenschaftsorientierung und Kontroversität in der ökonomischen Bildung. *GWP – Gesellschaft. Wirtschaft. Politik*, *64*(4), 445–450. https://doi.org/10.3224/gwp.v64i4.21143

Henrie, C. R., Halverson, L. R., & Graham, C. R. (2015). Measuring student engagement in technology-mediated learning: A review. *Computers & Education*, *90*, 36–53. https://doi.org/10.1016/j.compedu.2015.09.005

Hermansyah, H., Gunawan, G., Harjono, A., & Adawiyah, R. (2019). Guided inquiry model with virtual labs to improve students' understanding on heat concept. *Journal of Physics: Conference Series*, *1153*, 012116. https://doi.org/10.1088/1742-6596/1153/1/012116

Hermidayani, H., Mukhtar, M., & Tambunan, H. (2019). The effect of learning model and critical thinking toward learning outcome in economics of the tenth graders in senior high school. *Proceedings of the 2nd Annual Conference of Engineering and Implementation on Vocational Education (ACEIVE 2018), November 3, 2018, North Sumatra, Indonesia*. https://doi.org/10.4108/eai.3-11-2018.2285666

Hirsh, Å., Nilholm, C., Roman, H., Forsberg, E., & Sundberg, D. (2022). Reviews of teaching methods – Which fundamental issues are identified? *Education Inquiry*, *13*(1), 1–20. https://doi.org/10.1080/20004508.2020.1839232

Hwang, G., & Chen, C. (2017). Influences of an inquiry-based ubiquitous gaming design on students' learning achievements, motivation, behavioral patterns, and tendency towards critical thinking and problem solving. *British Journal of Educational Technology*, *48*(4), 950–971. https://doi.org/10.1111/bjet.12464

Hwang, G. J., Wu, P. H., Zhuang, Y. Y., & Huang, Y. M. (2013). Effects of the inquiry-based mobile learning model on the cognitive load and learning achievement of students. *Interactive Learning Environments*, *21*(4), 338–354. https://doi.org/10.1080/10494820.2011.575789

Hwang, G.-J., Chiu, L.-Y., & Chen, C.-H. (2015). A contextual game-based learning approach to improving students' inquiry-based learning performance in social studies courses. *Computers & Education*, *81*, 13–25. https://doi.org/10.1016/j.compedu.2014.09.006

Iacovidou, E., Hahladakis, J. N., & Purnell, P. (2020). A systems thinking approach to understanding the challenges of achieving the circular economy. *Environmental Science and Pollution Research*, *28*(19), 24785–24806. https://doi.org/10.1007/s11356-020-11725-9

Ignell, C., Davies, P., & Lundholm, C. (2013). Swedish upper secondary school students' conceptions of negative environmental impact and pricing. *Sustainability*, *5*(3), 982–996. https://doi.org/10.3390/su5030982

Jerrim, J., Oliver, M., & Sims, S. (2019). The relationship between inquiry-based teaching and students' achievement. New evidence from a longitudinal PISA study in England. *Learning and Instruction*, *61*, 35–44. https://doi.org/10.1016/j.learninstruc.2018.12.004

Jiang, S., Williams, A. E., Schenke, K., Warschauer, M., & O'Dowd, D. (2014, July 4). *Predicting MOOC performance with week 1 behavior*. Educational Data Mining. https://www.semanticscholar.org/paper/Predicting-MOOC-performance-with-Week-1-Behavior-Jiang-Williams/0f2e9943e4d6054a43e2029a8379a420bd8f9899

Kaiser, T., Birke, F., & Lutter, A. (2015). Schülerkonzepte zu ordnungspolitischen Fragen: Eine phänomenographische Untersuchung. *Zeitschrift Für Didaktik Der Gesellschaftswissenschaften*, *1*(6), 92–110.

Kleinschmidt, M., Fischer, S., Fischer, F., & Lange, D. (2015). Globalisierung, globale Ungleichheit und Entwicklung in den Vorstellungen von Schüler/inne/n. Die empirische Untersuchung von Lernvoraussetzungen als Ausgangspunkt für die Gestaltung Globalen Lernens. *Zeitschrift für internationale Bildungsforschung und Entwicklungspädagogik*, *38(3)*, 26–30. https://doi.org/10.25656/01:14055

Kumari, P., Arora, S. K., & Tiwari, S. (2015). Impact of inquiry-based teaching model on academic achievements in social science subject of 9th class student of secondary schools located in urban area. *International Journal of Recent Research Aspects*, *2*(4), 154–158.

Lazonder, A. W., & Harmsen, R. (2016). Meta-analysis of inquiry-based learning: Effects of guidance. *Review of Educational Research*, *86*(3), 681–718. https://doi.org/10.3102/0034654315627366

Lemme, L., & Neuhof, J. (2014). Verstehensweisen von Staat: Eine empirische Untersuchung der Lernersicht. In G. Weißeno & C. Schelle (Eds.), *Empirische Forschung in gesellschaftswissenschaftlichen Fachdidaktiken: Ergebnisse und Perspektiven* (pp. 111–125). Springer.

Li, Q., & Baker, R. (2018). The different relationships between engagement and outcomes across participant subgroups in massive open online courses. *Computers & Education*, *127*, 41–65. https://doi.org/10.1016/j.compedu.2018.08.005

Loerwald, D. (2017). Mehrperspektivität und ökonomische Bildung. In T. Engartner, B. Krisanthan, & Gesellschaft für Politikdidaktik und Politische Jugend- und Erwachsenenbildung (Eds.), *Wie viel ökonomische Bildung braucht politische Bildung?* (pp. 61–69). Gesellschaft für Politikdidaktik und Politische Jugend- und Erwachsenenbildung, Schwalbach/Ts. Wochenschau Verlag.

Maier, G., & Altmann, G. (2018). *Wirtschaft & Du: Gymnasium SI Baden-Württemberg*. *Schülerband* (Druck A3). Westermann.

Meitriana, M. A., Irwansyah, M. R., & Suwena, K. R. (2021). Inquiry learning: Strategy to improve economic learning outcomes and student activities. *Journal of Research & Method in Education*, *11*(1), 35–41.

Meng, F., & Jumaat, N. F. B. (2024). The Effectiveness of an online inquiry-based learning environment towards secondary school students' behavioral engagement and performance

in science. *International Journal of Interactive Mobile Technologies*, *18*(18), 112–124. https://doi.org/10.3991/ijim.v18i18.50547

Meyer, K. A. (2014). Student engagement in online learning: What works and why. *ASHE Higher Education Report*, *40*(6), 1–114. https://doi.org/10.1002/aehe.20018

Miles, D., Mensinga, J., & Zuchowski, I. (2018). Harnessing opportunities to enhance the distance learning experience of MSW students: An appreciative inquiry process. *Social Work Education*, *37*(6), 705–717. https://doi.org/10.1080/02615479.2018.1447557

Nuraini, U., Restuningdiah, N., Sidharta, E. A., & Utami, H. (2021). *Research-based learning to improve students' critical thinking skills in studying business ethics*. International Conference on Strategic Issues of Economics, Business, and, Education (ICoSIEBE 2020), Medan, Indonesia. https://doi.org/10.2991/aebmr.k.210220.033

Piller, S. (2016). *Wirtschaft im Politikunterricht: Ökonomie, Ökonomische Bildung und Institutionenökonomik*. Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-10579-2

Prabhu, G. N. (2020). Teaching the scope and limits of generalizability in qualitative research. In *New trends in qualitative research* (pp. 186–192). Ludomedia. https://doi.org/10.36367/ntqr.1.2020.186-192

Riedel, H., & Burghardt, Y. (2018). *Wirtschaft & Co.: Wirtschaft / Berufs- und Studienorientierung (WBS) für das Gymnasium: Gesamtband: Baden-Württemberg* (1st ed.). C.C. Buchner Verlag.

Scheiter, K., Schüler, A., & Eitel, A. (2017). Learning from multimedia: Cognitive processes and instructional support. In S. Schwan & U. Cress (Eds.), *The psychology of digital learning* (pp. 1–19). Springer International Publishing. https://doi.org/10.1007/978-3-319-49077-9_1

Slavin, R. E., & Lake, C. (2009). *Effective educational programs: Meta-findings from the best evidence encyclopedia*. Society for Research on Educational Effectiveness. https://eric.ed.gov/?id=ED524709

Subedi, M. (2023). Use of mixed methods in social sciences research. *Nepalese Journal of Development and Rural Studies*, *20*(1), 96–105. https://doi.org/10.3126/njdrs.v20i01.64166

Tan, C. Y., Hong, X., Gao, L., & Song, Q. (2023). Meta-analytical insights on school SES effects. *Educational Review*, *77*(1), 274–302. https://doi.org/10.1080/00131911.2023.2184329

Trowler, V., Allan, R. L., Bryk, J., & Din, R. R. (2022). Pathways to student engagement: Beyond triggers and mechanisms at the engagement interface. *Higher Education*, *84*(4), 761–777. https://doi.org/10.1007/s10734-021-00798-1

Ulrich, P. (2008). *Integrative economic ethics: Foundations of a civilized market economy*. Cambridge University Press.

Ulrich, P. (2012). Wirtschaftsethik als aktuelle Bildungsaufgabe. In G. Pfleiderer, G. Pfleiderer, & P. Seele (Eds.), *Wirtschaftsethik kontrovers: Positionen aus Theorie und Praxis* (1st ed., pp. 153–158). Nomos Verlagsgesellschaft mbH & Co. KG.

Voet, M., & De Wever, B. (2018). Effects of immersion in inquiry-based learning on student teachers' educational beliefs. *Instructional Science*, *46*(3), 383–403. https://doi.org/10.1007/s11251-017-9439-8

Wiliam, D. (2022). How should educational research respond to the replication "crisis" in the social sciences? Reflections on the papers in the special issue. *Educational Research and Evaluation*, *27*(1–2), 208–214. https://doi.org/10.1080/13803611.2021.2022309

Yasa, A. D., Rahayu, S., Handayanto, S. K., & Ekawati, R. (2024). Evaluating the impact of smart learning-based inquiry on enhancing digital literacy and critical thinking skills.

Ingénierie Des Systèmes d Information, *29*(1), 219–233. https://doi.org/10.18280/isi.290122

Zafra-Gómez, J. L., Román-Martínez, I., & Gómez-Miranda, M. E. (2015). Measuring the impact of inquiry-based learning on outcomes and student satisfaction. *Assessment & Evaluation in Higher Education*, *40*(8), 1050–1069. https://doi.org/10.1080/02602938.2014.963836

Zheng, L., Li, X., Tian, L., & Cui, P. (2018). The effectiveness of integrating mobile devices with inquiry-based learning on students' learning achievements: A meta-analysis. *International Journal of Mobile Learning and Organisation*, *12*(1), 77. https://doi.org/10.1504/IJMLO.2018.089238

Appendix A

Interview guidelines (Study 1)

Main theme: Responsibility

1. Consumer behaviour (consumption and abstinence)

- To what extent do you think your consumption decisions can influence companies?

Order ethics (Macro level)

- Do you think the state is responsible for regulating consumer behaviour?

  [If nothing comes up: An example is the state imposing higher taxes on products when companies fail to consider sustainability in their production.]

Corporate ethics (Meso level)

- Are companies responsible for ensuring that their products are made under fair working conditions, or do you think the responsibility lies with the companies in the respective countries where people work under poor conditions? How did you come to your assessment?

Individual ethics (Micro level)

- To what extent can you already take responsibility for your consumption?

  [If nothing comes up: An example is only buying sustainable products.]

Case study

The company Wiesenhof slaughters seven chickens per second, amounting to 4.5 million chickens per week. During the 30-day rearing period, the animals have little space, and their bones sometimes break under their own weight. Only 10,000 of them are privileged. These are organic chickens, which have more space, more time to grow, and a better life. The problem is that hardly anyone wants to buy them. Therefore, Wiesenhof slaughters only 10,000 chickens per week. However, if asked, more than 70% of Germans express their willingness to pay more for meat if it meant less factory farming (Riedel & Burardt, 2018, p.79).

- What do you think is the cause of this discrepancy?
- Do you believe consumers can influence companies' production methods with their purchasing behaviour?

2. The business cycle

Introduction to the topic:

- Are you familiar with the business cycle? Have you covered it in economic lessons?

  [If not: show a diagram of the business cycle.]

Order ethics (Macro level)

- What responsibility do you think the state has in the business cycle?

Corporate ethics (Meso level)

- What responsibility do companies have in the business cycle?

Individual ethics (Micro level)

- Do you think every individual should act responsibly? An example is a teenager saving some of the money they earn from a part-time job (such as delivering newspapers) instead of spending it immediately.

Case study

Siemens is one of Germany's largest companies, producing all kinds of technology – from locomotives to large power plants. In 2017, the Munich-based company made headlines when its CEO, Joe Kaeser, announced the elimination of 7,000 jobs. Two plants in Leipzig and Görlitz, where over 900 employees manufacture steam turbines, are to be closed entirely. This decision drew much criticism. Despite the company's yearly profit of 6.2 billion euros, many find it incomprehensible that entire plants are to be shut down, especially those that are not performing poorly. Siemens faces a challenge: due to the energy transition and digitalisation, the company must restructure its offerings to remain competitive internationally. For instance, coal power plants will become less common [...]. Siemens now intends to invest more in future-oriented sectors, such as renewable energy (Birke et al., 2017, p.132).

- How would you assess the impact on the region if the largest employer there leaves?
- Can and should the state intervene?

3. Market forms

- Are rules necessary for an economic system? Why or why not?
- Would you say such rules restrict or protect the respective actors?

  [Possibly confirm or refute the position again if not clear: Should everyone be allowed to act with few restrictions?]

Order ethics (Macro level)

- Is the state obligated to set legal frameworks for market actions? Please justify your opinion.

Corporate ethics (Meso level)

- To what extent should companies be responsible for their existence in the labour market? If so, would it be fair for them to exercise their power?

Individual ethics (Micro level)

- Would you say that each individual is responsible for their work and, for example, the surrounding working conditions? How did you come to your assessment?

Case study

In 2017, three ice cream shop owners in Tübingen simultaneously raised the price per scoop from 1.20 to 1.50 euros. Two said that they had agreed to do so. However, since price-fixing is prohibited, the Ministry of Economic Affairs in Stuttgart is now investigating a possible "ice cream agreement" in Tübingen. [...] Also, Tübingen's mayor, Boris Palmer, expressed his dissatisfaction on Facebook about the high ice cream prices: [...] "Dear ice cream shop owners. It is unfair to squeeze customers through price-fixing. No, it is illegal. I would advise you to reconsider and lower the prices to a level that is objectively justifiable with increased costs. Otherwise, the cartel office might step in and impose fines" (Maier & Altmann, 2018, p. 51).

- What is your opinion: Do you think state interventions are sensible? Would you say the state is responsible for ensuring that ice cream shops do not collude?

4. Power relations

- Which actor should exert the most power in the economic system?
    - Why do you think this actor should have the most power?

Order ethics (Macro level)

- To what extent is the state obligated to regulate power relations in the economic system?

Corporate ethics (Meso level)

- Are companies themselves responsible for how much power they have in the economic system? How did you come to your assessment?

Individual ethics (Micro level)

- As a consumer, how do you assess your power in the economic system?

Case study

Since 2013, those who wish to travel through Germany by public transport are no longer solely dependent on the train. This is due to the government's amendment of the Passenger Transport Act. Since then, long-distance buses have been allowed to compete with trains. Many providers have entered this new market. The number of passengers and routes offered are steadily increasing. However, competition among long-distance bus operators is fierce. Only a few can keep up with the market leader Flixbus's pricing policy. The company has since acquired most of its competitors, most recently Postbus in 2016. As a result, Flixbus now holds a 90.8% market share in long-distance buses (based on offered route kilometres) (Riedel & Burardt, 2018, p.80).

- What is your opinion: Do you think it is fair that Flixbus holds so much market power? How did you come to your assessment?

Appendix B

Overview of variables, instruments, and additional statistical analyses (Study 2)

Table 18

Overview dependent variables

Measured constructs	Instrument	Format	Number of items	Internal consistency reliability	When conducted?
Attitudes towards economics	Attitudes towards social responsibility (Oberrauch & Seeber, 2021)	5-point Likert scale scale	4 items	α = 0.818	Pre, post
	Attitudes towards income distribution (Niehues, 2014)	10-point scale	1 item	-	Pre, post
	Normative attitude in relation to auction (Cipriani et al., 2009; Rubinstein, 2006)	Ranking of 3 types of distributions	1 item	-	Pre, post
	Attitudes towards responsibility in the economic system	5-point Likert scale	14 items	α = 0.818	Pre, post
Economic competence and knowledge	Economic competence (Kaiser et al., 2020)	Multiple choice with varying options	12 items	α = 0.599	Pre, post
	Economic knowledge	4 response options	12 items	α = 0.52	Post
Economic interest	Economic content interest (adapted and translated by Oberrauch & Seeber, 2021; Walstad & Soper, 1983)	5-point Likert scale	4 items	α = 0.876	Pre, post
	Intrinsic motivation in economics (Deci & Ryan, 1985; translated by Wilde et al., 2009)	5-point Likert scale	6 items	α = 0.837	Post
Digital competences	Knowledge of Data protection (Masur et al., 2017)	3-point Likert scale	14 items	α = 0.506	Pre, post
	Knowledge of digital security (Peart et al., 2020)	5-point Likert scale	9 items	α = 0.887	Post
	Digital media handling competencies (Gerick & Eickelmann, 2017)	6-point Likert scale	12 items	α = 0.887	Post

Table 19

Overview covariates

Measured constructs	Instrument	Format	Number of items	Internal consistency reliability	When conducted?
Demographic information	Gender, age, school, grade, home language, books at home, parents' education, math grade, german grade	Open-ended and multiple-choice	10 items	-	Pre
Cognitive abilities	Cognitive abilities (Heller et al., 1998)	Pattern selection task	4 items	α = 0.463	Pre
Attitudes towards money and competition	Attitudes towards money (translated by Barry & Breuer, 2012; Yamauchi & Templer, 1982)	5-point Likert scale	4 items	α = 0.856	Pre
	Attitudes towards competition (Fülöp et al., 2008; translated and validated by Oberrauch & Seeber, 2021)	5-point Likert scale	5 items	α = 0.790	Pre
Preferences	Risk (Falk et al., 2016)	10-point Likert scale	1 item	-	Pre
	Trust (Falk et al., 2016)	2 response options	1 item	-	Pre
	Altruism (Falk et al., 2016)	4-point Likert scale	1 item	-	Pre
	Impulse buying (Falk et al., 2016)	4-point Likert scale	1 item	-	Pre
BIG 5 Personality	BIG 5 personality model (Gerlitz & Schupp, 2005)	5-point Likert scale	10 items	α = 0.501	Pre
Sustainability consciousness	Knowledge of sustainability (Gericke et al., 2019)	5-point Likert scale	12 items	α = 0.745	Pre
Test motivation	Test motivation (Wise & Kong, 2005)	5-point Likert scale	10 items	α = 0.494	Pre
	Test motivation	9-point Likert scale	1 item	-	Post

Table 20

Difference-in-differences analysis of the intervention effect

Variable	Estimate	Std. Error	t value	p value
Economic interest	0.121	0.089	1.351	0.177
Economic competences	-0.018	0.236	-0.078	0.938
Attitudes responsibility	-0.033	0.038	-0.878	0.380
Knowledge of data protection	-0.173	0.191	-0.906	0.365
Normative attitudes	0.175	0.192	0.912	0.362

Note. The table reports results from a difference-in-differences analysis comparing changes from pre- to post-test between the treatment and control groups.

Table 21

Standardized mean differences before and after matching

Variable	SMD Before Matching	SMD After Matching
Gender	-0.194	-0.092
SES	0.080	-0.013
Secondary School	-0.052	0.000
Math Grade	-0.154	0.000
German Grade	-0.100	-0.021
Cognitive Abilities	0.052	0.070
Economic Interest	0.092	0.026
Attitudes Towards Money	-0.097	-0.061
Social Responsibility	-0.066	-0.180
Competition	-0.082	-0.036
Altruism	-0.211	-0.059
Time Preference	0.054	-0.011
Impulse Purchases	-0.064	0.044
Auction	0.082	0.027
Price Fairness	0.091	0.000
Extraversion	-0.117	-0.045
Agreeableness	-0.083	-0.033
Conscientiousness	0.271	-0.011
Neuroticism	0.162	0.138
Openness	0.049	-0.010
Economic Competence	-0.012	-0.051
Data Security	-0.061	-0.071
Responsibility	0.056	0.046
Social Problem Solving	-0.036	-0.077
Reduce Bad Consumption	0.029	-0.054
State Influence	0.047	-0.084
Test Motivation	0.036	-0.066
Economic Knowledge	0.086	0.000
Digital Media Competence	-0.029	-0.018
Digital Security Skills	-0.147	0.004

Note. This table presents standardized mean differences (SMDs) before and after propensity score matching. Values closer to 0 indicate better covariate balance. A commonly used threshold for acceptable balance is an SMD below 0.1. Matched sample: $N = 108$ treated, $N = 108$ control; unmatched: $N = 81$ treated; discarded: $N = 0$.

Table 22

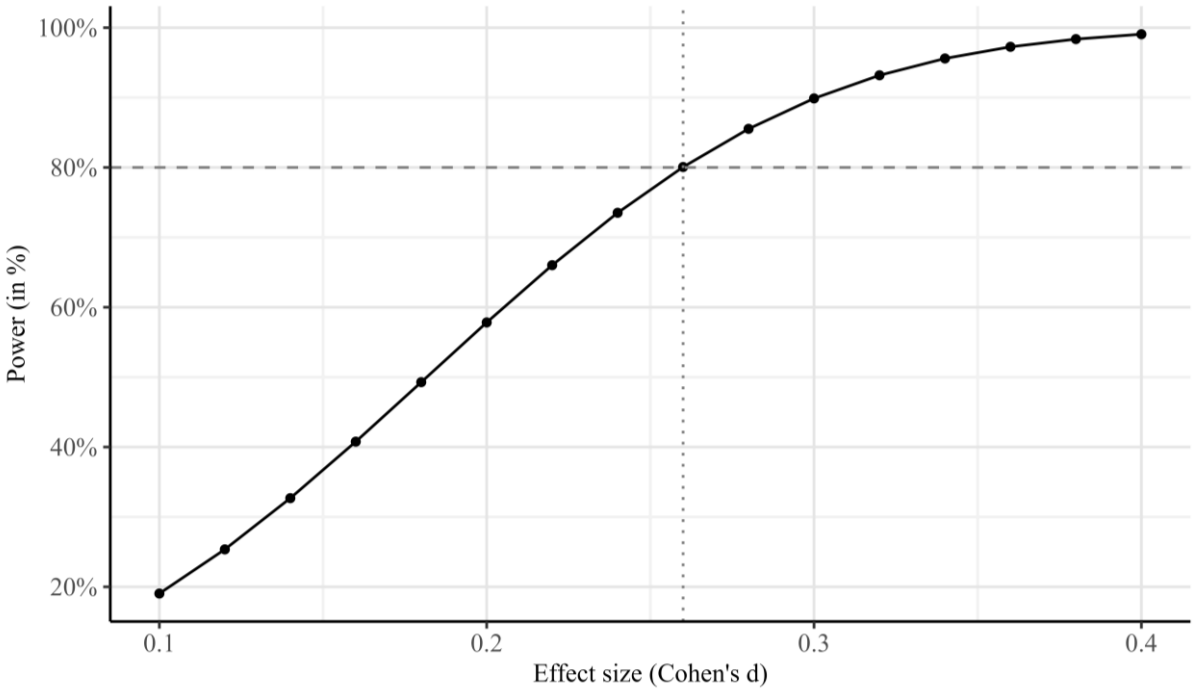
Power analysis of the treatment effect

Variable	N	Mean	Effect size (β)	SE	Power (%)
Female learners					
Economic interest	263	2.993	0.351	0.149	86
Intrinsic motivation	263	3.210	0.461	0.143	91.5
Male learners					
Economic interest	181	3.244	-0.478	0.193	89.5

Note. The table reports a simulation-based power analysis using model assumptions derived from the observed data. For female learners (approximately 9 students per class), model parameters were ICC = 0.009, $R^2_1 = 0.257$, and $\omega^2 = 0.054$ for economic interest, and ICC = 0.188, $R^2_1 = 0$, and $\omega^2 = 0.345$ for intrinsic motivation. For male learners (approximately 6 students per class), economic interest showed ICC = 0.162, $R^2_1 = 0.092$, and $\omega^2 = 0.578$. The power analysis was computed in R (version 4.4.2 (2024-10-31 ucrt)) using the package powerup (Bulus et al., 2021). The alpha level was set to .05.

Figure 12

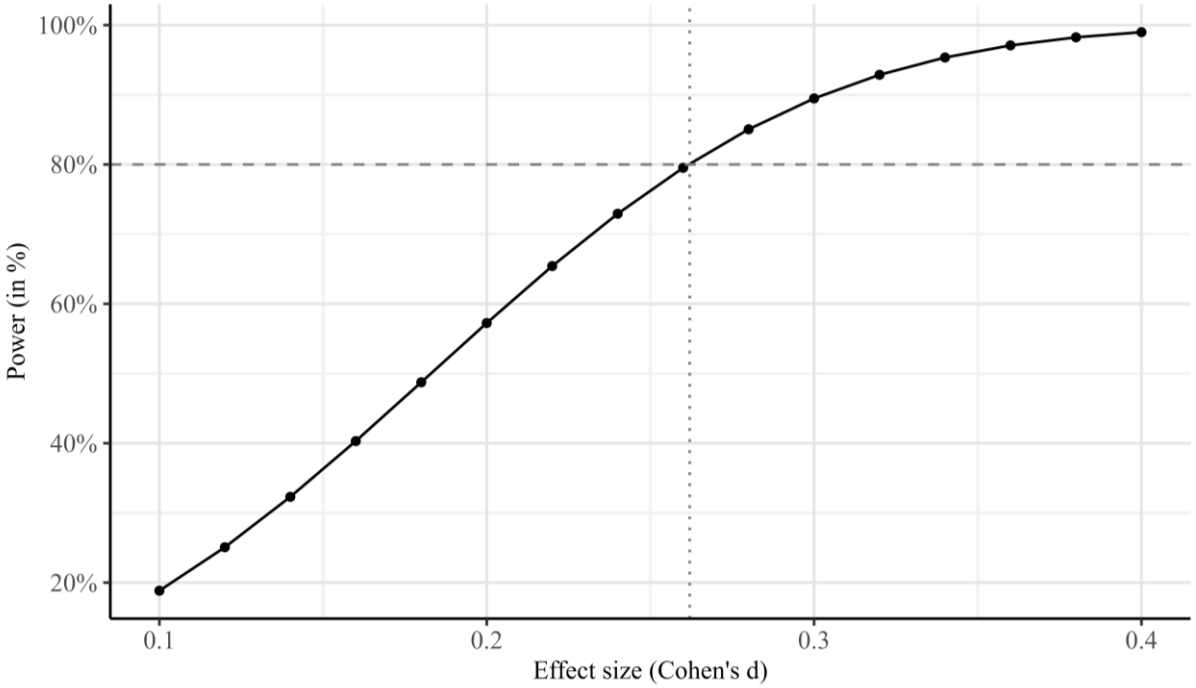
Minimum detectable effect size of economic interest



Note. This figure presents the relationship between effect size (Cohen's d) and statistical power for the outcome economic interest. The dashed horizontal line indicates the 80% power threshold, and the vertical dashed line marks the minimum detectable effect size (MDES). The analysis was conducted with a total sample size of $N = 445$. The MDES was estimated at 0.26 with a 95% confidence interval of [0.076,0.443]. The analysis was computed in R (version 4.4.2 (2024-10-31 ucrt)) using the package powerup (Dong & Maynard, 2013).

Figure 13

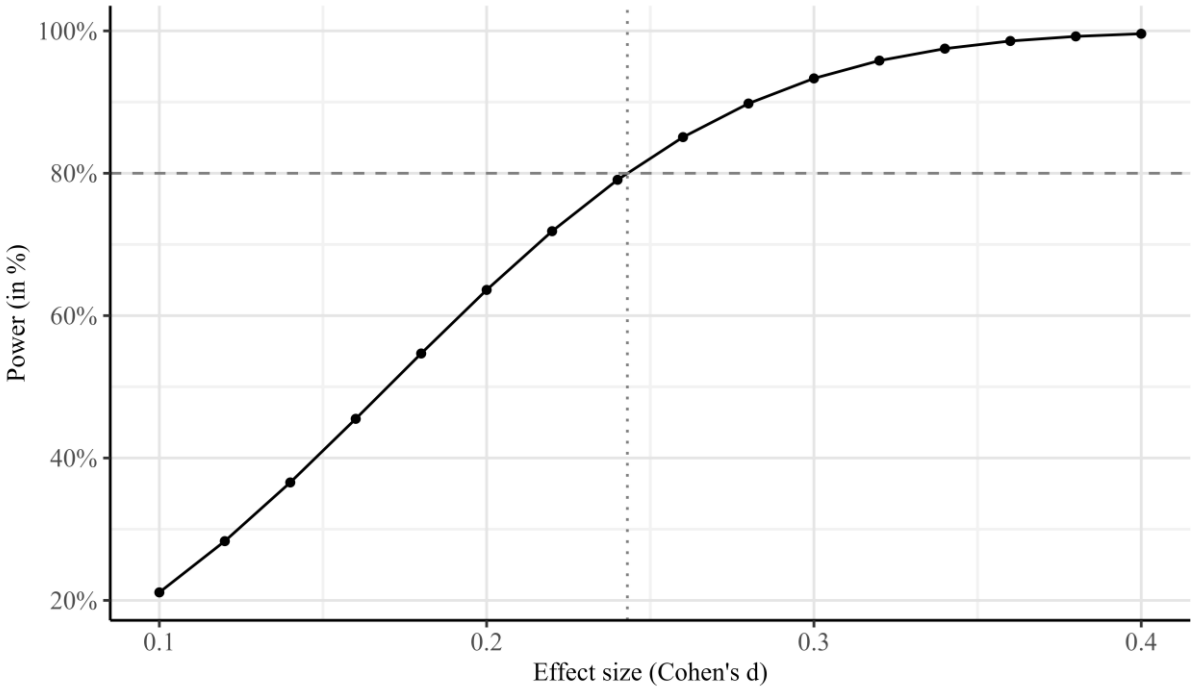
Minimum detectable effect size of intrinsic motivation



Note. This figure presents the relationship between effect size (Cohen's d) and statistical power for the outcome intrinsic motivation. The dashed horizontal line indicates the 80% power threshold, and the vertical dashed line marks the minimum detectable effect size (MDES). The analysis was conducted with a total sample size of $N = 445$. The MDES was estimated at 0.262 with a 95% confidence interval of [0.077,0.446]. The analysis was computed in R (version 4.4.2 (2024-10-31 ucrt)) using the package powerup (Dong & Maynard, 2013).

Figure 14

Minimum detectable effect size of economic competence



Note. This figure presents the relationship between effect size (Cohen's d) and statistical power for the outcome economic competence. The dashed horizontal line indicates the 80% power threshold, and the vertical dashed line marks the minimum detectable effect size (MDES). The analysis was conducted with a total sample size of $N = 445$. The MDES was estimated at 0.243 with a 95% confidence interval of [0.071,0.414]. The analysis was computed in R (version 4.4.2 (2024-10-31 ucrt)) using the package powerup (Dong & Maynard, 2013).

Appendix C

Descriptive data, instruments, and regression analyses (Study 3)

Table 23

Number of media items by type across grade 8-relevant modules

	Module Consumer behavior	Module The sharing economy	Module Data management
Videos	7	3	3
Audios	3	1	1
Statistics	9	5	6
Books	19	23	19
Caricatures	4	5	3
Trainings	5	2	2
Position lines	8	11	10
Spacedeck	-	-	-
Etherpad	-	-	-
Messenger	-	-	-

Table 24

Click effort per media type

Media	**Access effort (in clicks)**
Training	2
Videos	3
Audios	2
Etherpad	2
Spacedeck	2
Position lines	2
Caricatures	2
Books	2
Statistics	2
Messenger	2

Table 25

Multilevel regression results predicting economic competence development based on learner behavior

Fixed effect	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Videos	0.007 (0.061)	0.005 (0.061)	0.004 (0.061)	0.005 (0.061)	0.005 (0.061)	0.008 (0.061)	0.023 (0.066)	0.023 (0.066)	0.027 (0.067)	0.024 (0.067)
Audios	-0.239 (0.137)	-0.237 (0.137)	-0.229 (0.137)	-0.240 (0.137)	-0.238 (0.138)	-0.236 (0.136)	-0.257 (0.143)	-0.276 (0.142)	-0.263 (0.144)	-0.244 (0.146)
Statistics	-0.062 (0.069)	-0.060 (0.070)	-0.050 (0.070)	-0.050 (0.070)	-0.051 (0.070)	-0.055 (0.069)	-0.056 (0.074)	-0.060 (0.073)	-0.070 (0.075)	-0.069 (0.076)
Books	-0.048 (0.046)	-0.045 (0.046)	-0.048 (0.046)	-0.054 (0.047)	-0.053 (0.047)	-0.055 (0.047)	-0.062 (0.049)	-0.065 (0.048)	-0.065 (0.050)	-0.065 (0.050)
Caricatures	0.209* (0.098)	0.212* (0.098)	0.203* (0.098)	0.215* (0.099)	0.215* (0.099)	0.209* (0.099)	0.234* (0.104)	0.251* (0.104)	0.253* (0.106)	0.247* (0.107)
Trainings	0.055* (0.026)	0.057* (0.026)	0.057* (0.026)	0.056* (0.026)	0.056* (0.026)	0.052 (0.027)	0.058* (0.029)	0.061* (0.029)	0.061* (0.029)	0.058* (0.030)
Position lines	0.113 (0.085)	0.117 (0.085)	0.134 (0.086)	0.130 (0.086)	0.129 (0.086)	0.135 (0.086)	0.183 (0.098)	0.179 (0.097)	0.171 (0.098)	0.171 (0.098)
Spacedeck	0.109* (0.042)	0.109* (0.042)	0.104* (0.042)	0.104* (0.042)	0.104* (0.042)	0.115** (0.042)	0.120** (0.044)	0.115** (0.044)	0.111* (0.044)	0.114* (0.044)
Etherpad	0.014 (0.092)	0.008 (0.092)	0.006 (0.092)	0.007 (0.092)	0.006 (0.093)	-0.010 (0.092)	-0.027 (0.095)	-0.022 (0.095)	-0.030 (0.098)	-0.022 (0.099)
Messenger	0.043 (0.144)	0.038 (0.145)	0.038 (0.144)	0.026 (0.145)	0.026 (0.145)	0.025 (0.145)	-0.036 (0.158)	-0.038 (0.157)	-0.029 (0.160)	-0.062 (0.163)
SES		-0.378 (0.621)	-0.393 (0.619)	-0.362 (0.623)	-0.369 (0.625)	-0.382 (0.629)	-0.569 (0.668)	-0.656 (0.674)	-0.573 (0.692)	-0.565 (0.693)
Female			0.457 (0.316)	0.414 (0.329)	0.399 (0.338)	0.488 (0.350)	0.500 (0.375)	0.436 (0.374)	0.470 (0.399)	0.482 (0.400)
German performance				-0.131 (0.172)	-0.155 (0.207)	-0.140 (0.209)	-0.170 (0.223)	-0.161 (0.222)	-0.186 (0.226)	-0.211 (0.227)
Math performance					0.037 (0.182)	-0.027 (0.185)	-0.059 (0.201)	-0.067 (0.202)	-0.049 (0.204)	-0.028 (0.207)
Economic interest						-0.137 (0.187)	-0.048 (0.198)	-0.047 (0.198)	-0.009 (0.205)	-0.011 (0.206)
Cognitive abilities							0.035 (0.204)	0.058 (0.204)	0.013 (0.208)	0.037 (0.209)
Preferences								0.063 (0.323)	-0.003 (0.327)	-0.013 (0.331)
Personality									-0.328 (0.386)	-0.264 (0.392)
Normative attitudes										-0.450 (0.417)
N	288	288	288	287	287	280	253	250	244	243
R^2 (marginal)	0.092	0.093	0.099	0.100	0.100	0.107	0.121	0.122	0.118	0.117
R^2 (conditional)	0.247	0.248	0.255	0.253	0.253	0.258	0.283	0.275	0.265	0.263
ICC	0.171	0.171	0.173	0.170	0.170	0.169	0.184	0.173	0.167	0.166

Note. N = 288 students in 22 classes; ICC = intraclass correlation coefficient, i.e., proportion of between-class variance. Marginal R^2 = variance explained by fixed effects; Conditional R^2 = variance explained by fixed and random effects. Statistically significant results at p = .001 are marked ***. Analyses conducted in R (version 4.4.2) using the *lme4* and *performance* packages.

Table 26

Multilevel regression results predicting sustainability based on learner behavior

Fixed effect	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Videos	0.017 (0.016)	0.018 (0.016)	0.017 (0.015)	0.017 (0.015)	0.016 (0.015)	0.012 (0.015)	0.017 (0.016)	0.017 (0.016)	0.017 (0.016)	0.017 (0.016)
Audios	0.016 (0.035)	0.014 (0.035)	0.019 (0.035)	0.015 (0.035)	0.009 (0.034)	0.008 (0.034)	0.004 (0.035)	0.007 (0.035)	-0.003 (0.035)	-0.000 (0.035)
Statistics	-0.033 (0.018)	-0.035 (0.018)	-0.030 (0.018)	-0.031 (0.018)	-0.030 (0.018)	-0.028 (0.018)	-0.031 (0.019)	-0.032 (0.019)	-0.040* (0.018)	-0.038* (0.019)
Books	0.010 (0.012)	0.008 (0.012)	0.006 (0.012)	0.004 (0.012)	0.000 (0.012)	-0.004 (0.011)	-0.002 (0.012)	-0.002 (0.012)	0.004 (0.012)	0.004 (0.012)
Caricatures	0.001 (0.025)	-0.002 (0.025)	-0.005 (0.025)	-0.004 (0.025)	-0.004 (0.024)	0.009 (0.024)	0.005 (0.025)	0.004 (0.025)	0.001 (0.025)	-0.001 (0.025)
Trainings	-0.001 (0.006)	-0.002 (0.006)	-0.003 (0.006)	-0.003 (0.006)	-0.003 (0.006)	-0.001 (0.006)	-0.002 (0.007)	-0.003 (0.007)	-0.002 (0.007)	-0.002 (0.007)
Position lines	-0.007 (0.020)	-0.010 (0.020)	-0.004 (0.020)	-0.005 (0.020)	-0.005 (0.019)	-0.005 (0.020)	0.012 (0.021)	0.012 (0.021)	0.014 (0.021)	0.012 (0.021)
Spacedeck	0.001 (0.011)	0.002 (0.011)	-0.000 (0.011)	-0.000 (0.011)	0.000 (0.011)	-0.002 (0.011)	-0.004 (0.011)	-0.003 (0.011)	0.000 (0.011)	-0.000 (0.011)
Etherpad	0.067** (0.024)	0.072** (0.024)	0.071** (0.024)	0.071** (0.024)	0.075** (0.023)	0.079*** (0.023)	0.079** (0.024)	0.078** (0.024)	0.071** (0.023)	0.073** (0.024)
Messenger	-0.053 (0.038)	-0.048 (0.038)	-0.048 (0.037)	-0.049 (0.037)	-0.049 (0.037)	-0.056 (0.036)	-0.067 (0.039)	-0.067 (0.039)	-0.063 (0.038)	-0.070 (0.039)
SES		0.336* (0.170)	0.321 (0.168)	0.291 (0.169)	0.316 (0.166)	0.343* (0.164)	0.353* (0.175)	0.353* (0.178)	0.309 (0.173)	0.305 (0.173)
Female			0.250** (0.084)	0.205* (0.088)	0.260** (0.089)	0.295** (0.090)	0.274** (0.097)	0.278** (0.098)	0.152 (0.099)	0.149 (0.100)
German performance				-0.077 (0.046)	0.012 (0.054)	0.039 (0.054)	0.029 (0.058)	0.027 (0.058)	0.060 (0.057)	0.058 (0.057)
Math performance					-0.141** (0.048)	-0.157** (0.048)	-0.160** (0.052)	-0.159** (0.052)	-0.176*** (0.051)	-0.170** (0.052)
Economic interest						0.125** (0.048)	0.141** (0.051)	0.140** (0.052)	0.111* (0.051)	0.113* (0.051)
Cognitive abilities							0.020 (0.053)	0.017 (0.053)	0.022 (0.052)	0.023 (0.052)
Preferences								-0.037 (0.085)	-0.008 (0.082)	-0.018 (0.083)
Personality									0.410*** (0.096)	0.403*** (0.098)
Normative attitudes										0.023 (0.105)
N	278	278	278	277	277	275	248	246	243	242
R^2 (marginal)	0.061	0.074	0.101	0.108	0.134	0.157	0.169	0.170	0.228	0.227
R^2 (conditional)	0.072	0.088	0.115	0.121	0.148	0.178	0.179	0.178	0.241	0.239
ICC	0.012	0.015	0.015	0.014	0.016	0.025	0.013	0.010	0.016	0.015

Note. N = 278 students in 22 classes; ICC = intraclass correlation coefficient, i.e., proportion of between-class variance. Marginal R^2 = variance explained by fixed effects; Conditional R^2 = variance explained by fixed and random effects. Statistically significant results at p = .001 are marked ***. Analyses conducted in R (version 4.4.2) using the *lme4* and *performance* packages.

Table 27

Pairwise comparisons of economic competence development between learner profiles

Group comparison	Effect size (r)	P-value (adj.)
All-rounders vs. Auditors/Viewers	**0.274***	**0.032**
All-rounders vs. Quiz-takers	0.200	0.230
All-rounders vs. Disengagers	**0.188***	**0.027**
Disengagers vs. Quiz-takers	0.024	0.994
Auditors/Viewers vs. Disengagers	-0.072	0.843
Auditors/Viewers vs. Quiz-takers	-0.044	0.980

Note. The table presents pairwise comparisons of economic competence between learner profiles based on Games-Howell post hoc tests following Welch's ANOVAs. Effect sizes (r) are reported for each comparison. Asterisks (*) indicate statistically significant differences at $p < .05$ (adjusted for multiple comparisons). The reference group in each comparison is listed second.

Table 28

Pairwise comparisons of economic knowledge between learner profiles

Group comparison	Effect size (r)	P-value (adj.)
All-rounders vs. Disengagers	**0.378*** **	**< .001**
All-rounders vs. Auditors/Viewers	**0.247***	**0.042**
All-rounders vs. Quiz-takers	0.222	0.115
Auditors/Viewers vs. Disengagers	0.160	0.261
Disengagers vs. Quiz-takers	-0.144	0.428
Auditors/Viewers vs. Quiz-takers	-0.000	1.000

Note. The table presents pairwise comparisons of economic knowledge between learner profiles based on Games-Howell post hoc tests following Welch's ANOVAs. Effect sizes (r) are reported for each comparison. Asterisks (*) indicate statistically significant differences at $p < .05$ (adjusted for multiple comparisons). The reference group in each comparison is listed second.

Table 29

Pairwise comparisons of digital media competence between learner profiles

Group comparison	Effect size (r)	P-value (adj.)
All-rounders vs. Disengagers	**0.282*** **	**< .001**
All-rounders vs. Quiz-takers	0.238	0.093
All-rounders vs. Auditors/Viewers	0.203	0.222
Auditors/Viewers vs. Disengagers	0.054	0.945
Auditors/Viewers vs. Quiz-takers	0.012	1.000
Disengagers vs. Quiz-takers	-0.046	0.959

Note. The table presents pairwise comparisons of digital media competence between learner profiles based on Games-Howell post hoc tests following Welch's ANOVAs. Effect sizes (r) are reported for each comparison. Asterisks (*) indicate statistically significant differences at $p < .05$ (adjusted for multiple comparisons). The reference group in each comparison is listed second.

Declaration on authors' contributions

This publication-based dissertation includes three manuscripts that were written together with other authors. The proportional contributions to the manuscripts are presented in the subsequent tables.

Chapter 2:
Responsible behaviour in the context of utility maximisation – An interview study on pupils' business ethics conceptions

Author	Author position	Scientific ideas %	Data generation %	Analysis & interpretation %	Paper writing %
Victoria Estler	first	70	100	90	70
Taiga Brahm	second	30	0	10	30
Status in publication process:		Published			

Chapter 3:
Exploring the impact of a digital inquiry-based learning environment on competence development in secondary economic education

Author	Author position	Scientific ideas %	Data generation %	Analysis & interpretation %	Paper writing %
Victoria Estler	first	60	100	70	80
Malte Ring	second	20	0	15	10
Taiga Brahm	third	20	0	15	10
Status in publication process:		Revised and resubmitted			

Chapter 4:
Engagement and learner behavior in a digital environment: Implications for secondary economic education

Author	Author position	Scientific ideas %	Data generation %	Analysis & interpretation %	Paper writing %
Victoria Estler	first	80	100	70	80
Taiga Brahm	second	10	0	15	10
Malte Ring	third	10	0	15	10
Status in publication process:		Submitted			

Declaration of originality and use of AI

I, Victoria Estler, hereby confirm that this dissertation is my own original work. I certify that I have not called on the help of a third party that has not been made apparent in my statements.

I declare that in the revision of the work, I have made use of generative artificial intelligence.

AI tools have been used in the following ways:

- ChatGPT 4.0 and 5.0 to generate translations included in the submitted work,
- ChatGPT 4.0 and 5.0 to improve the language of my own phrases.

As the author of this work, I take full responsibility for its content, claims, and references.