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# THE POTENTIAL FOR THE DIDACTIC INTEGRATION OF TABLETS IN GENERAL EDUCATION

## THESIS OF THE DOCTORAL (PhD) DISSERTATION

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## 1. Problem Statement

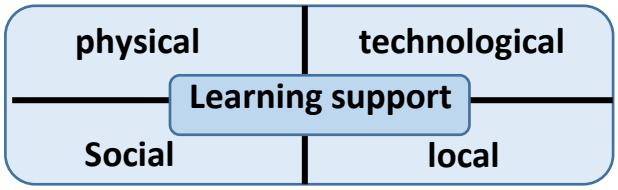
The Fourth Industrial Revolution and digital transformation present the education ecosystem not only with a technological challenge, but also demand a profound paradigm shift. The starting point for the problem under examination is that the introduction of tablets into the classroom should not be treated merely as a matter of equipment procurement or hardware, since the device in itself is a 'lifeless object'. The real issue is a systemic shift in didactic culture: how technology become an organic pedagogical environment that supports learning? This pressure to adapt, as well as the challenges posed by the unregulated presence of educational technology, is well reflected in  by Government Decree 245/2024 (8 August), which links the use of mobile devices to explicitly pedagogical, learning-supporting purposes.

The aim of the dissertation goes beyond a descriptive analysis of the situation: its aim is to create an empirically validated, practically applicable didactic integration model that can assist teachers in adapting to the expectations of the 21st-century networked society.

## 2. Theoretical framework of the research

### 2.1. The learning environment as an umbrella concept and new media dramaturgy

The research interprets classroom digitalisation within a multidisciplinary framework (a synthesis of pedagogy, psychology and media studies). The theoretical foundation builds on the concept of Kálmán and Kopp (2022), who argue that the learning environment is an integrative 'umbrella concept'. This holistic framework encompasses five fundamental dimensions that are closely interrelated: the physical, technological, social, local and pedagogical dimensions. It follows that the tablet (as a technological dimension) does not in itself bring about qualitative change unless it is explicitly linked to the pedagogical (didactic) dimension.




1. *Figure: Dimensions of a learning environment that supports learning (based on Kálmán-Kopp's figure – created by the author)*

In this changed environment, the traditional logic of information transfer is being replaced by non-linear content access based on new media database logic, known as 'new media dramaturgy' (Forgó, 2013). Learners' cognitive habits have transformed: the traditional, static printed interface has been replaced by interactive screen culture (Komenczi, 2009; Szűts, 2020), and through the spatial and temporal expansion of learning forms, formal, informal and non-formal spaces converge in a seamless learning system.




*2. Figure: Mind map of the dissertation's focal points*

### 2.2. Synthesis of learning theory paradigms and the PICRAT model

In the integration of ICT tools, the dissertation applies the following pedagogical paradigms:

- *Behaviourism:* Through the immediate, gamified feedback (rewards, points) provided by adaptive software, the consolidation of basic skills becomes more effective (Polito & Temperini, 2019).
- *Constructivism:* Knowledge is not a passively transmitted entity, but an active, internal construction within the learner's mind (Nahalka, 2002). Here, the tablet serves as a cognitive 'building block' for problem-solving and multimedia content creation.
- *Connectivism:* Knowledge exists in distributed, networked systems, and learning is the interconnection of these nodes (Siemens, 2005). BYOD (bring your own device) and cloud-based systems are tools for connective knowledge sharing.

To map these theories in practice, the research uses Hughes's **PICRAT model** (Kimmons, Graham, & West, 2020) as a framework, integrating it with Engeström's (2001) activity theory. The PICRAT matrix captures the methodological depth of educational processes by examining the relationship between the learner (Passive, Interactive, Creative) and the teacher (Substitute, Augment, Transform) in relation to technology.

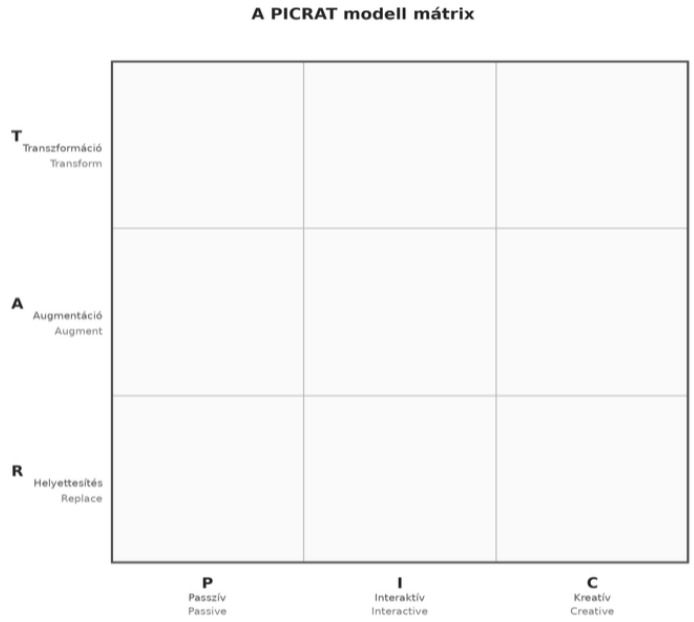



*Figure 3: The PICRAT model matrix (own creation)*

## 3. Methodology of the empirical research

### 3.1. Research questions, hypotheses and mixed-methods strategy

To answer the complex research questions, I chose Creswell's interpretive sequential (KVANT + qual) mixed-methods strategy (Creswell, 2012).

The three focus areas of the study:

1. *Cognitive dimension:* How does the didactic integration of tablets affect the effectiveness of the teaching-learning process and students' cognitive activities?
2. *Affective and social dimension:* What changes does the use of these devices bring about in student motivation and in the area of socio-cultural equality of opportunity?
3. *Teacher dimension:* How does digitalisation transform teachers' workload (innovation shock) and the sharing of knowledge within networks?

### 3.2. Population and sample

The study was conducted using a deliberate sampling approach in three institutions with markedly different infrastructural and socio-cultural backgrounds:

- Eger (Training School): project-based, transformative education.
- Gyál (Urban area): Samsung Smart School interactive system.
- Hejőkeresztúr (Small town): Complex Instructional Programme (KIP) with a focus on status management and disadvantage compensation.

The total sample comprised N=307 pupils and N=29 teachers (questionnaires), N=31 teachers and N=33 pupils (focus group interviews), and N=41 classroom observations.

| Method | Location | Number of teachers | Number of pupils |
|---|---|---|---|
| Teacher–student questionnaire | Eger, Hejőkeresztúr, Gyál | N=29 | N=307 |
| Teacher–pupil group interview | Eger, Hejőkeresztúr, Gyál | N=31 | N=33 |
| Class recordings (N=41) | Eger | N=13 | N=190 |
| Class visits | Eger, Hejőkeresztúr, Gyál | N=18 | N=230 |

1. *Table 3: Characteristics of the research sample in figures (own creation)*

### 3.3. Validity and reliability of the research

In accordance with the rigorous standards of doctoral research, I operationalised the internal validity of the four-level triangulation (data, methodological, personal and theoretical) used in this study using the following quality indicators:

- *Internal consistency (reliability) of the questionnaires:* I verified the homogeneity of the Likert-type scales using Cronbach's alpha coefficients. The students' (N=307) aggregated scale titled 'Perception of Educational Impact' demonstrated robust internal consistency ($\alpha = 0.84$). The teachers' sample (N=29) 'Pedagogical Effectiveness' scale exhibited stable homogeneity despite the small sample size ($\alpha = 0.79$).

- *Reliability of qualitative coding (Inter-coder agreement):* To avoid subjective bias during the deductive and in vivo coding of the focus group interviews, I employed a peer debriefing procedure ( ). The involvement of an independent control coder on 15% of the sample confirmed 88% coder agreement. Credibility was also reinforced by a member check.
- *Reliability of objective observation (Noldus Observer XT):* To filter out human error factors (IRR – Inter-Rater Reliability) in the second-by-second video interaction analyses (N=41 lessons) conducted using Noldus software, I used the built-in Reliability Analysis module. The test, run with a ±2-second time window tolerance to correct for random coincidences, yielded excellent observer agreement, with a Cohen's κ value of 0.82.




*4. Figure: Validity and reliability of the research*

## 4. Research findings in relation to PICRAT and the research questions

A summary of the empirical results highlights that the success of the educational process is not on the presence of ICT, but on the pedagogical quality of its integration.

*Cognitive effectiveness and differentiation (Research Question 1):* Improvements in academic performance (e.g. an increase of +0.4 decimal points in chemistry and +0.23 decimal points in mathematics in Year 9) were realised exclusively in cases of differentiated task setting. The tablet shifted students from the Passive-Substitute level towards creative content creation: during external fieldwork, the time spent on passive reception fell radically (to 10–15%), whilst active creative work (photo/video documentation, synthesis) reached 35–50%. The strategy of

pedagogical differentiation ensured individual learning pace in 80% of lessons, preventing student frustration.

*Affective factors, interaction and equal opportunities (Research Question 2):* Data measured using the Noldus software provided precise evidence of a shift in the interaction space: the traditional frontal teaching time slot shrank to 25%, whilst teacher facilitation rose to 50%. 57% of students and 93% of teachers observed an increase in intrinsic motivation during Interactive-level tasks. A particularly important social outcome is the empirical validation of the 'Digital School Uniform' theory: in a heterogeneous environment (e.g. Hejőkeresztúr), the institutionally provided, standardised 1:1 device fleet successfully masked status differences, in contrast the BYOD model, which often exacerbates wealth disparities (Kuznia, 2012).

*Teachers' workload and networked knowledge sharing (Research Question III):* The most ambivalent results emerged on the teachers' side. 82% of teachers reported an 'innovation shock' and an extreme workload (in some cases 30 hours) at the time of implementation. In response, they adopted a spontaneous, connective coping strategy: in the absence of formal training, informal online groups (Facebook, YouTube) became the primary venues for professional survival and knowledge sharing. The data also revealed infrastructural determinism (Ertmer, 1999): in the event of network instability, teachers exhibited immediate methodological regression, falling back on the Passive-Substitute 'Plan B'.

| **Research question / Hypothesis** | **Methods used** | **Key findings (Quantitative)** | **Explanatory interpretation (Qualitative / PICRAT)** |
|---|---|---|---|
| **I/1. Academic performance** | Grade analysis, Questionnaire, Interview | Grade improvement of +0.4 and +0.18; 85% teacher satisfaction. | Pedagogical quality and immediate feedback improve performance at the **Advanced (A)** level. |
| **I/2. Interactive problem-solving** | Noldus ODX, Questionnaire, Interview | 50% active time; 77% focus on practice. | Frontal teaching is reduced, and the student becomes self-directed (**Interactive / I**). |

| Research question / Hypothesis | Methods used | Key findings (Quantitative) | Explanatory interpretation (Qualitative / PICRAT) |
|---|---|---|---|
| **I/3. Creative content creation** | Noldus ODX, Interview | 35–50% creative time at external locations. | The learning space expands (fieldwork), and the student transitions from a passive learner to a **Creative (C) and Transformative (T)** creator (photography, PPT). |
| **I/4. Differentiation** | Questionnaire, Noldus, Interview | 62% of teachers consider it effective. | Progress at one's own pace, frustration-free, **Enriching (E)** environment (e.g. using the KIP method). |
| **II/1. Motivation and experience** | Questionnaire, Interview | 93% of teachers and 57% of students report increased motivation. | Gamification maintains intrinsic motivation (**Interactive / I**). |
| **III/1. Workload** | Questionnaire, Interview | 46% consider it a burden; preparation time has doubled. | Moving to higher (A-T) PICRAT levels initially requires 30-hour working days. |
| **III/3. Methodological regression** | Noldus ODX, Interview | 23% time management issues; frequent technical faults. | If the network connection is lost ("no internet"), **"Plan B"** is activated, which **involves reverting** to **the Passive (P)** level. |

*Table 2: : Research questions, hypotheses and synthesis of results*

## 5. Discussion, Summary and Recommendations

### 5.1. Discussion: Synthesis of results with educational science paradigms

The research data and hypotheses (9 out of 10 hypotheses were confirmed, with 1 having a strong limitation) resonate perfectly with the dominant paradigms in educational science.

- The cognitive gains from differentiation through interactive applications (H1, H2, H4) support István Nahalka's (2002) constructivist approach to knowledge construction: the student no longer 'expects the solution from the teacher, but must check their own work' (Borbás, 2026).
- The creation of individual products (videos, Prezi presentations) (H3) is an empirical manifestation of Papertian constructionism at the Creative (C) level.
- The "Digital School Coat" as an opportunity-creating function (H7) resonates with Kuznia's (2012) sociological theses on ensuring equal opportunities.
- The textbook example of teacher networking (H8, H9) to compensate for innovation shock is a case in point of Siemens's (2005) connectivism.
- The forced frontal 'Plan B' (H10) necessitated by the instability of the network, meanwhile, validates Ertmer's (1999) theory of first- and second-order barriers: deficiencies in technical infrastructure immediately override even the most excellent methodological plans.

A didaktikai integráció hatásainak bizonyíték-alapú szintézise




| Vizsgált dimenzió | Mért adat | Következtetés / Hatás |
|---|---|---|
| Kognitív eredményesség | **+0,4 érdemjegy (Kémiából)** | A növekmény kizárólag differenciált feladatadás esetén realizálódott. Önmagában a tablet nem javít jegyet. |
| Pedagógus terhelés | **82% (Innovációs sokk)** | Extrém felkészülési teher. Csak informális konnektív hálózatok (FB csoportok) kompenzálták. |
| Társadalmi esélyek | **1:1 Modell (Iskolaköpeny)** | Az intézményileg biztosított eszközflotta makroszinten sikeresen elfedi a státuszkülönbségeket. |

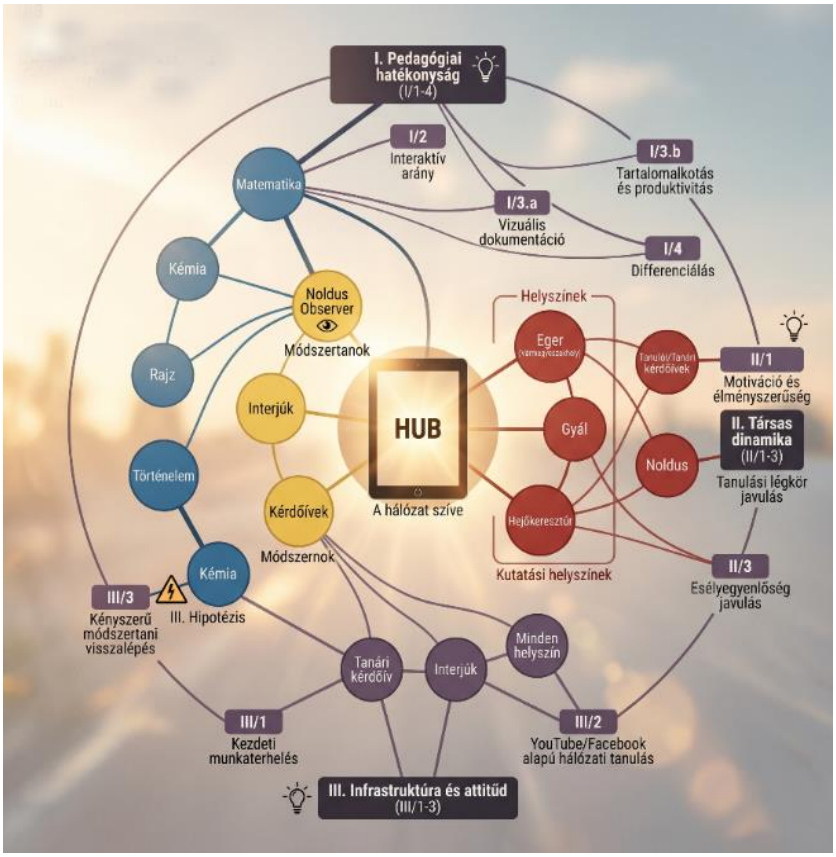
5. *Figure: Discussion – Theoretical synthesis and evaluation of hypotheses*

### 5.2. Summary and the implementation model for didactic integration

The main conclusion of the dissertation: *"The tablet is never the goal, but merely a catalyst*". Technology is capable of breaking down the isolation of the lectern, transforming passive students into active content creators, and bridging social divides. But all this can only be realised if the technological dimension of the learning environment, as defined by Kálmán and Kopp (2022), is organically integrated with the didactic objectives. Acquiring a tool is easy; changing the didactic culture, however, is the most difficult pedagogical task.

Based on the findings of the research, the following development and implementation guidelines can be formulated for the Hungarian public education system:

1. *Infrastructural stability:* To avoid methodological regression (the forced activation of a 'Plan B'), reliable bandwidth and device management are no longer merely IT concerns but fundamental pedagogical interests.
2. *Ensuring equal opportunities:* In contrast to the BYOD model, maintaining the "Digital School Uniform" (1:1 institutional fleet) must be treated as a policy priority, particularly in disadvantaged regions, with the aim of bridging the digital divide through technology.
3. *A shift in pedagogical culture in teacher training:* In professional development, the focus should be on TPACK- and PICRAT-based planning, as well as on creating pedagogical value, rather than on mere software use (button-pushing).
4. *Networked (connective) knowledge management:* We must institutionalise and legitimise informal networked learning among teachers (Facebook groups, internal link collections), and we must open up to 'reverse mentoring', where students with greater technological expertise help teachers overcome technical difficulties.




*1. Figure: Logical summary of the dissertation*

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