Henning Schoenenberger *Editor*

Connected Learning: Origins, Opportunities, and Perspectives of Contemporary Educational Design

A Machine-Generated Literature Overview

Springer

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- An extraction-based summarizer identifies the most important sentences of a text and uses the original sentences to create the summary.
- An abstraction-based summarizer creates new text based on deep learning. New phrases are created to summarize the content.

The auto-summaries you will find in this book have been generated via an extractive summarization approach.

Each chapter was carefully edited by Henning Schoenenberger. The editors selected the papers which were then auto-summarized. The editors have not edited the auto-summaries due to the extraction-based approach, and have not changed the original sentences. You will find the editors' reviews and guidance on the auto-summaries in their chapter introductions.

In machine-generated books, editors are defined as those who curate the content for the book by selecting the papers to be auto-summarized and by organizing the output into a meaningful order. Next to the thoughtful curation of the papers, editors should guide the readers through the auto-summaries and make transparent why they selected the papers.

The ultimate goal is to provide a current literature review of Springer Nature publications on a given topic in order to support readers in overcoming information overload and to help them dive into a topic faster; to identify interdisciplinary overlaps; and to present papers which might not have been on the readers' radar.

Please note that the selected papers are not used to train an LLM while the auto-summaries are created.

Introduction

The German avant-garde school Staatliches Bauhaus (1919–1933), led by Walter Gropius, Hannes Meyer and Mies van der Rohe, can still provide important insights today on how modern, interdisciplinary learning and teaching can be designed. More than ever, we need to overcome the boundaries of the usual academic disciplines in order to find and try out interdisciplinary solutions for the major problems of our time. It is obvious that traditional school forms with streamlined frontal teaching are no longer able to adequately ensure modern, solution-oriented learning and understanding of complex problem areas.

In my search for solutions, I came across several approaches. An important eye-opener was the American education visionary Connie Yowell, who in 2016 at a panel at the Art Institute of Chicago and the IIT Institute of Design explained how little student-centered and not developed with the learner in mind our traditional school system still is. Its original purpose, to keep and sort children in the transition from an agricultural to an industrial society, is still being achieved surprisingly effectively. Yowell counters this: "If we think about learning or if we think about education as something that is for the learner and that is designed for kids as they are aging, it would never look anything like what we have currently designed."[1] Following this, she uses the term *Connected Learning*, which plays a central role in this literature overview: "It turns out that learning is networked, that it exists within ecosystems and that it has a whole different kind of set of design principles that it requires. (. . .) We can now create ecosystems that support more personalized and connected learning than we ever have."[2]

The concept of Connected Learning picks up learners where they are, and that is no longer just the classroom or seminar room. Connected Learning tries to

[1] https://archive.org/details/podcast_iit-institute-design_school-as-lab-moholy-nagy_1000378488396 (Minute 23:16) (accessed on 20.4.2024).

[2] https://archive.org/details/podcast_iit-institute-design_school-as-lab-moholy-nagy_1000378488396 (Minute 26:10) (accessed on 20.4.2024).

understand the context of learning and the motivation of learners in order to design a more contemporary and effective learning experience. In this context, the insight plays a central role that Connected Learning is collaborative and takes place in peer-to-peer networks, that it is based on participation, problem orientation and application, and that learners are more interested the more personalized the learning is designed.

Starting from this concept of Connected Learning, numerous bridges can be built, for example, to the parallel concept of Networked Learning, which in the research literature, despite all overlap, focuses a bit more on higher education, adult and vocational education and training.

From both concepts, paths lead to digital badges and micro-credentials that can be used to reward, certify and map incremental learning—digital or analog, in the classroom, in private learning groups, in the workshop, office, etc. Likewise, digital badges and micro-credentials have set out to increase learning motivation and reduce the number of dropouts. It remains to be seen to what extent these approaches can keep their promises. In any case, they already make it clear that learning also unfolds over time and expands into lifelong learning around which appropriate learning opportunities are to be designed.

The temporal unfolding is reflected in the spatial unfolding of learning, which permeates ever more areas of life, especially in companies and businesses, where the learning of the future does not no longer just means sporadic further training, but learning—and teaching—will themselves be the work of the future.

Ed Catmull, one of the founders of the film studio Pixar Animation, makes it very clear in his book *Creativity, Inc.* what massive changes this also implies for the requirement profiles of executives and senior leaders, who are increasingly taking on the role of teachers:

"Are we thoughtful about how people learn and grow? As leaders, we should think of ourselves as teachers and try to create companies in which teaching is seen as a valued way to contribute to the success of the whole. Do we think of most activities as teaching opportunities and experiences as ways of learning?"[3]

This is where the circle closes. At the Bauhaus, this combination of training center and commercial enterprise, which generates profits, was already lived a hundred years ago. Perhaps this is a promising model of our future society to solve the major problems of our time. And who knows whether this learning of the future will not increasingly take place in virtual reality.

With the New European Bauhaus initiative announced in fall 2020, President of the European Commission Ursula von der Leyen is building on the historic Bauhaus of the Weimar Republic. In an interdisciplinary approach based on Bauhaus, the combination of aesthetics, sustainability and inclusion is intended to answer the question of how we want to live in the future. Over the past years, the initiative has built up an impressive project, discussion and festival infrastructure with currently

[3] Ed Catmull: Creativity, Inc.: overcoming the unseen forces that stand in the way of true inspiration. Random House, New York, 2014. P. 123.

764 partner institutions.[4] In contrast to the original Bauhaus, commercial companies are excluded from partnerships. Without companies, however, it will not work to pull the lever and invest in growth in sustainability, growth in circular economy, aesthetics and inclusion. Excluding commercial partners is a mistake. The original Bauhaus always wanted to be commercial too.

What is needed instead is a European design initiative that proves that there is commercial added value in sustainability, a New European Design Thinking, with a basic course along the lines of Johannes Itten's Bauhaus preliminary course, in which all conventions are first thrown overboard in order to learn the new climate requirements from scratch, for example.

This book is an automatically generated and curated literature overview of current research in the fields of Connected Learning, Networked Learning, digital badges, micro-credentials and lifelong learning. With the exception of this introduction this book was created by an algorithm. The book contains automatically summarized current research articles from Springer Nature's research platform SpringerLink, which were clustered into coherent chapters and sequenced by a similarity-based algorithm. The machine selection and summarization of the articles allows readers with limited time to get a quick overview of the research area and at the same time, if necessary, to click through to the original articles to delve deeper. In addition, the book serves as a source of inspiration for one's own research and helps to get an overview of current researchers in the respective research fields.

The chapter introductions were automatically generated by GPT, manually revised and supplemented. GPT is a large language model (LLM) developed by OpenAI, which can generate comprehensible text using deep learning. For the text generation, the following two prompts were used, followed by the chapter-by-chapter abstracts of the selected research articles:

- Write a book chapter introduction in two paragraphs. The first paragraph should include a brief overview of the topic. The second paragraph should include more granular technical and fundamental analysis.
- Write a book chapter introduction which should include a detailed overview of the topic that includes granular and technical details.

[4] https://europa.eu/new-european-bauhaus/about/official-partners_en (accessed on 20.4.2024).

Contents

Chapter 1
Connected Learning: Opportunities and Implications for Twenty-First-Century Education

Introduction by the Editor

In the twenty-first century, the world is more connected than ever before. The rise of the internet and social media has made it possible for people to connect with each other and share information instantaneously. This has led to a new era of learning, where people are able to learn from each other and share their knowledge with the world.

Connected Learning is an approach that has been proposed to address the needs of learners in the digital age.

One of the most important aspects of Connected Learning is the ability to connect with others who share the same interests. This can be done through online communities, forums, and social media. By connecting with others, students can learn from their experiences and share their own. This type of learning is often more effective than conventional methods, as it allows students to learn at their own pace and in their own time.

Another important aspect of Connected Learning is the ability to access information and resources that are not available in the local community. By connecting with people from all over the world, students can access a wealth of knowledge and resources that they would not otherwise have. This can be particularly useful for people who live in rural or isolated areas, as they can connect with others who can provide them with information and resources.

The Connected Learning framework emphasizes the importance of three key elements: (1) interest-driven learning, (2) peer support of learners, and (3) participation as a robust form of learning, all of which transcend temporal, spatial and cultural boundaries. Connected Learning does not reduce learning to a phenomenon that takes place exclusively in the restricted spaces of formal education, nor does it focus exclusively on the online learning phenomenon. As such, the conceptualization of

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Connected Learning needs to be deepened to effectively be able to rationalize how people learn in the digital age.

The papers in this first chapter provide an outline of Connected Learning and research in contexts such as STEAM,[1] middle school and higher education, rural and regional schools, civic engagement and—while trying to measure its impact—also add the international perspective.

Machine-Generated Summaries

The summaries in this chapter were generated from Springer Nature publications using extractive AI auto-summarization: An extraction-based summarizer aims to identify the most important sentences of a text using an algorithm and uses those original sentences to create the auto-summary (unlike generative AI). As the constituted sentences are machine selected, they may not fully reflect the body of the work, so we strongly advise that the original content is read and cited. The auto generated summaries were curated by the editor to meet Springer Nature publication standards.

Machine generated keywords: ito, connect, youth, connected learning, faculty, connected, interest, equity, stem, development, literacy, young people, educator.

New Alignments for the Digital Age: Insights into Connected Learning

This is a machine-generated summary of: Prestridge et al. [1].

To cite this content, please refer to the original papers.

For technical reasons we could not insert the page number to the original quote.

Abstract-Summary The emergence of socially constructed knowledge based on connected learning is democratising education and re-framing how formal and informal learning is considered.

Connected learning does not reduce learning to a phenomenon that takes place exclusively in the restricted spaces of formal education, neither does it focus exclusively on the online learning phenomenon.

Our conceptualisation of connected learning needs to deepen to effectively be able to rationalise how people learn in a digital age.

[1] Science, Technology, Engineering, the Arts, and Mathematics.

Introduction

While he often had to be forced to practice piano, Peter willingly spent hours playing guitar in his room, watching expert guitar players and tutorials on YouTube, listening to and singing along with his father and his band, and gradually learning to play his favourite guitar riffs.

His father coached Peter in guitar basics, tuning, and tools, often took him and his brother along to open jams with other working musicians, and always played a range of music in the house and car.

Building upon Ito's [2] description, connected learning is realized in this vignette of a young boy's personal interest in learning to play guitar, and pursuing his passion with the support of friends and caring adults, and with support of knowledgeable others in the connected internet community, and in turn, has been able to link this learning and interest to academic achievement in school, potential employment as a tutor, and civic engagement by playing in coffee shops and at open jams.

Concept 1: An Open and Bounded Context

This MOOC is underpinned by a connected learning design in which faculty from across disciplines engage in a series of prepared tasks and activities and contribute ideas and expertise to collaborative, yet self-directed, networked learning experiences, and in turn, incubate ideas, construct and share knowledge, and own the dynamics of the space.

In an intentional design to promote agency, oriented by connectivist learning theory, the QGS MOOC demonstrates three of four MOOC characteristics, adapted from Bates [3] and originally described by Downes [4]: (1) autonomy of the learner (faculty participate when and where, learning is personal, accountability) (2) diversity of tools, learners, and knowledge (multimedia, multiple disciplines, diverse and emerging content) and (3) interactivity (cooperative learning, open and ongoing communication between learners, emergent knowledge).

In drawing together the ideas within the cases of digital platforms and MOOCs, connected learning can be propositioned by a certain kind of context in which designs for agency explicitly advantage interactivity and co-creation of knowledge over content consumption.

Concept 2: Prescribed and Emergent Curriculum

An emergent curriculum can be considered as a non-formal framework, that does not arise from the prescribed curriculum but rather derives from institutional or social practices within connected learning processes.

An emergent curriculum arises from the openness, interaction, and self-organization at scale of the information and knowledge production in social networks, which can generate an exponential growth of emerging learning modalities.

There has been some debate about the alignment of an emergent curriculum with connected learning (see Cox [5]) requiring several discussions and definitions regarding the growth of virtual communities and networks.

In open and distant learning, there has been an increase in the production of learning objects (LO) and open educational resources (OER).

The creation and use of OERs can represent both the formal and emergent curriculum, in a singular Learning Object or through collective use of resources bounded together for a purpose.

Concept 3: Rise of a New Class of Influencer

Research related to educators' connected learning activity through a single digital space, such as Twitter, Pinterest, Reddit, Facebook, and Edmodo indicate that teachers often turn to digital settings to augment their professional development due to the irrelevance of what is offered at the school site (Hood [6]; Prestridge [7]).

In India, an online certificate course called Reflective Teaching with ICT, designed for government rural teachers, created multiple PLNs (Personal Learning Networks) that connected teachers across districts to share their learning and practice on Telegram and Whatsapp platforms.

As connected learners, educators can cultivate a network of individuals who support and extend their learning, participate in spaces that grow their thinking, and use tools to access and curate new information; Teachers can improve their teaching and student learning, expand their social support, build confidence in their practice, and shift their identity to a teacher-learner or teacher-leader (Trust [8]).

Connected learning can be represented through formally-organized and informally-developed institutionally based networks as well as though more organic, self-driven networks.

Framing the Complexities of Conceptualised Connected Learning

These common elements will be discussed here to begin to represent the complexities of connected learning: (1) autonomy of the learner (2) diversity of tools, learners, and knowledge and (3) Issues of time.

With either lens, connected learning is a uniquely cultivated system of people, spaces, and tools that assist the improvement of a skill, knowledge and or process.

When educators or graduate supervisors cultivate a network of individuals who support and extend their learning, participate in spaces that grow their thinking, and use tools to access and curate new information, they can improve their affective, cognitive, identity, and social growth capabilities (Trust [8]).

This points to the multifaceted, dynamic nature of connected learning, in which participants can interact with people, spaces, and tools in multiple ways.

Connected learning encompasses an individual's autonomy of action for learning with tools, people and knowledges underpinned by their use of time.

Major Consideration with Moving Forward

The rhetoric for learning has typically focused on canonized formal institutional content acquisition with reference to discipline specific knowledge gains.

We are suggesting the need to be moving towards considering learning as 'mashups' of discipline knowledge with personal interests, experiences and expertise shaped by a multitude of choices as learning paradigms.

Considering the abundance of information suitable for learning available on the web today, our first principle is to encourage individuals new to digital technology to seek out subjects, topics, questions, problems which are of strong personal interest and which provide ample continuing motivation for study.

We have only just begun to put these elements (tools, people and knowledges) into some type of inter-relationship and ask the research community to examine each of these concepts to expand, identify relationships and further depth to this fascinating and critically-important new learning paradigm of connected learning.

Connected Learning in STEAM Classrooms: Opportunities for Engaging Youth in Science and Math Classrooms

This is a machine-generated summary of: Quigley et al. [9].

To cite this content, please refer to the original papers.

For technical reasons we could not insert the page number to the original quote.

Abstract-Summary We propose using connected learning theory to examine a previously developed STEAM conceptual model.

This work explores the potential of connected learning theory to understand specific STEAM instructional practices.

Using observations of 43 middle-grade teachers from 14 schools enacting STEAM practices in their classrooms, we examined what connected learning looked like in STEAM classrooms and how the STEAM conceptual model could be enhanced by analyzing implementation practices through the principles of connected learning.

This found significant overlap in ideas of connected learning and STEAM, notably a shared emphasis on design, collaboration, and contextualized learning.

Extended:

Future work highlights these overlaps in CL and our STEAM conceptual model, as well as provides more explicit professional development in the areas in which teachers demonstrated need is key to this line of research.

Purpose

We examined what CL looked like in STEAM classrooms and how STEAM implementation practices are enhanced by analyzing implementation practices through the principles of CL.

To do so, we expanded our current work to understand how CL (Ito and others [10]) binds the instructional practices together, and also areas in which our STEAM conceptual model (Quigley and others [11]) fell short of CL.

Understanding the Connected Learning Framework

Connected learning is a powerful examination of how students learn outside of school settings.

Learning principles (peer-supported, interest-powered, and academically oriented) make up the context for learning and can extend learning across home, community, and school settings.

The academically oriented context includes linking students' work with one another around their interests to adult experts, career opportunities, and their communities.

Students' learning experiences can extend beyond the school walls and the school-based community.

Technology is seen as the catalyst that provides opportunities for students as it fosters engagement and self-expression, increases accessibility, and expands social supports and diversity during interest-based learning.

The overlap between these principles intentionally demonstrates there are opportunities for students to enter into learning spaces in several ways, either through relevancy, opportunities to be supported by peers, rigorous content, involving a shared purpose, and opportunities for students to produce, or promote their work openly.

Exploring STEAM Conceptual Model

Infusing the arts, all of them, into STEAM instruction can provide greater opportunity for all students to access and benefit from cross-disciplinary, problem-based learning experiences.

The model supports teachers in designing problem-based curricula, roots scenarios within real-world issues, and draws on students' interests in digital technology activities as part of the problem-solving process.

Offering opportunities during the school day to all students is one way to broaden participation, as well as to increase participation through relevant problem-solving.

These include a problem-based approach, authentic tasks, multiple solutions, student choice, technology integration, teacher facilitation, and discipline integration.

This component describes the ways in which the teachers present material from multiple disciplines or content areas in relevant, real-world ways from which a problem is proposed.

When teachers perceived the goal of STEAM education as being a way to create an environment where peers will work together, this shifted the learning to ways that were less teacher-directed and more student-centered.

Methodology

This qualitative study examined the ways in which CL theory aligned to STEAM education practices in middle school math and science teachers (N = 43) during a 2-year study.

To do this, we analyzed the data using the following spheres for CL: peer supported, interest powered, academically orientated, production-centered, shared purpose, and openly networked.

Program and Participants

The participants in the study were all in service teachers who enrolled in a series of four STEAM classes taught by the first and second authors.

The teachers worked at 14 middle schools in a school district in the Southeastern USA.

It had a vested interest in re-engaging all learners in school and was working to transition most of its STEM or science-focused magnet schools to STEAM in an effort to meet that goal.

The STEAM district coordinator recruited the 43 middle school teachers in total (22 science teachers and 21 math teachers).

In terms of the participants' pre-conceptions of STEAM, the majority of the teachers (93% or 40/43) discussed STEAM as "STEM with the Arts."

Content of Teaching Environments

Each of the teachers designed a problem scenario that aligned to their standards (science and/or math), incorporating the STEAM conceptual model of technology integration, discipline integration, student choice, authentic tasks, and so on.

Each of these problem scenarios varied to make them locally relevant.

For a full list of the problem scenarios and the standards they aligned to, see supplementary material.

Note: several teachers co-designed problem-scenarios, and therefore, the total number of unique scenarios was 31.

The scenario was problem-based and relevant in that it was locally situated in the students' area and was a real-world problem that the city was attempting to solve.

Data Sources, Collection, and Analysis

The researchers trained on the observation rubric by using the following steps: (1) Researchers individually reviewed the rubric and then met together to discuss any areas of confusion. (2) Two researchers conducted the first observation together.

The third researcher reviewed the video data from the observation individually to determine if she was able to score the rubric reliably (inter-rater reliability was 87%). (4) The three researchers met to discuss differences.

After the observations, the researchers met with the teachers to discuss the lesson.

Our analysis included two levels of coding: first to determine whether STEAM practices were implemented and second to examine what CL looked like in STEAM classrooms.

Our primary data source, the observation notes, and video were analyzed first using a priori codes and categories of codes derived from the observation rubric (Quigley and others [11]).

Results

We provide narrative descriptions of the ways CL was represented in the STEAM classrooms.

Peer supported was evidenced through student choice, technological integration, and teacher facilitation.

Production centered was supported through technological integration and authentic tasks.

Learning Principle of Peer-Supported Opportunities

In STEAM classrooms, the opportunities for peer support were constructed through student choice, technology integration, and teacher-facilitation.

Technology was used as a tool to support peer-to-peer interaction both with and around the technology (in all classrooms during observations), to provide feedback on in-progress work ($n = 8$), to promote collaboration and media creation ($n = 32$), and to promote problem-solving around the content specifically ($n = 8$).

When the teacher developed the problem, tasks, and classroom environment to promote student-guided learning that relied on peer support and collaboration, the teacher noted that student engagement within the curricula was high.

By developing problems that impelled students to reach out to peers for assistance and work collaboratively, teachers encouraged developmentally appropriate levels of social and emotional engagement in learning, a component of CL (peer-supported contexts).

Learning Principle of Interest-Powered Opportunities

We found when teachers created opportunities for discipline integration, problem-based approaches, student choice, technology integration, and multiple solutions, it fueled students' interests.

Of the 38 teachers that incorporated multiple content areas, 25 connected the ideas to the problem-solving scenario based on students' interests.

When attempting to implement STEAM units that involved multiple disciplines, we found it was important that content connected the problem of study in a meaningful way, otherwise learning the content failed to become a part of the problem-solving and the students lost interest.

Of the 43 teachers, 36 implemented a problem-based approach where students learned by studying a relevant problem.

Teachers provided space for students to do this by ensuring that the problems they were solving were inquiry-rich and allowed for multiple solutions.

This aligns to the ideas of interest-powered approaches if the students are able to connect their interests to the ways they solve the problem.

Learning Principle of Academically-Orientated Opportunities

In the STEAM classrooms, we found the learning principle of academically orientated could be supported through discipline integration, problem-based approaches, and authentic tasks.

The academically oriented context included linking students' work with one another around their interests to adult experts, career opportunities, and their communities.

Many teachers (n = 29) integrated disciplines when they explicitly helped the students draw the links between the content and the problem-solving.

One of the components of creating an academically orientated space was creating opportunities for students to see the connection to civic engagement and careers.

We found that 32 of the teachers regularly discussed authentic approaches to problem-solving, including student-led inquiries and those designed by teachers.

Design Principle of Production-Centered Opportunities

Production-centered referred to the students' needs to create and produce products.

In the STEAM classrooms, we noted production-centered opportunities were created by integrating technology and encouraging multiple solution paths.

One technique to create production-centered opportunities was to integrate technology to do tasks digitally that typically students would have done non-digitally or to create production-centered properties.

An instructional strategy that supported various methods or ways to address an issue was readily aligned with a learning environment that invited participation from all students in ways that made sense to them.

Design Principle of Shared Purpose

In STEAM classrooms, teachers created relevant problems for students to solve that aligned to their curriculum.

When students were allowed to group according to their interests ($n = 6$), a shared purpose formed which provided a cohesion to the group and the problem solving.

For the teachers that did group students this way, they noted that the students seemed more focused on solving the problems.

There was less of a need for the teachers to direct the specific research lines as the students were able to do this because of their shared interest in the problem or pathway to solve the problem.

Design Principle of Openly Networked Opportunities

Students shared their products in the school in more open ways such as on the morning school news, the online newspaper, or posting videos to a shareable site.

Students were able to impact their school community by sharing what they learned during the STEAM problem-solving.

Explicitly designing curricula that incorporates online tools that encourage multiple solutions promotes multiple access and entry points for students to engage in more openly networked spaces.

We did not see completely openly networked opportunities in our study, and so the ideas of technology integration and multiple solutions are opportunities for teachers to extend this work.

Discussion

Exploring how CL looked in STEAM classrooms assisted us in determining ways that teachers can provide opportunities for engagement and deeper learning in schools, work that is largely understudied (Kumpulainen and Sefton-Green [12]).