Applicability of the Studio Pedagogy for the Future Workforce

Kari-Pekka Heikkinen, D.

Sc. Oulu University,

FINLAND Kari-

Pekka.Heikkinen@oulu.fi

Kongkiti Phusavat, Ph.D.*

Kasetsart University, THAILAND

fengkkp@ku.ac.th

Praneeth Peumal Galhena

Kasetsart University, THAILAND

fengpdp@ku.ac.th

*Corresponding author

Abstract:

This study seeks to adapt practices of a studio pedagogy to prepare university graduates for the workplacein the era of Industry 4.0. The study recognizes that work involves both performing tasks and learning on the job, and thus workplace learning is essential for continuous improvement, particularly in the face of recent business uncertainties stemming from the pandemic, geopolitical conflicts, and rapidly- changing business environments and customer expectations. Exploring the potential of workplace learning in a classroom setting, the study was conducted using a special form of studio pedagogy known as the LAB Studio Model, implemented through the Oamk LABs educational program at Oulu University of Applied Sciences in Finland. By observing and reviewing the relevant literature of the LAB Studio Model implementation, the study identified 12 key factors that contribute to learning and motivation to learn. The preliminary findings of the study highlight the importance of workplace learning and suggest the need for further investigation into how this approach can be effectively integrated into a classroom setting. By demonstrating the potential of the LAB Studio Model and workplace learning approaches, the study can inform the development of effective educational programs that prepare students for the challenges and opportunities of Industry 4.0.

Keywords: Workplace learning,Industry 4.0, LAB Studio Model, motivation, human capital.

Introduction

The need and challenge for improving workplace learning stems from many ongoing developments. Transitioning into Industry 4.0 requires drastic adjustments in many areas (Gomes *et al*., 2015; and Anselmann, 2022). From product and customer strategies to digitalisation of work processes, many companies need to fully embrace the development of their workforce or human capital (World Economic Forum, 2018). Instead of training, a company in the era of Industry 4.0 needs to focus on learning, specifically human learning (Masood and Pareto, 2021). In this era, employees and workers are expected to perform the required tasks while continuously learning about work (which can relate to work itself, customers, suppliers, regulators, and other workers). The fundamental questions are not only about how an individual learns (while fulfilling the task requirements) but also how effectively an individual learns and is motivated to learn (Kluger and DeNisi, 1996; and Masood and Pareto, 2021).

In today's business environment, due to a decline in the workforce and a need to become more resident and agile, the ability to learn and the speed of learning are recognized as an important competitive advantage (Argyris, 1991; and Johnson *et al*., 2018). Given many past business uncertainties created by the 'Black Swan' events such as the COVID-19 pandemic and the geopolitical risk in Europe and Asia (e.g., Ukraine and Taiwan), how an organisation adapts to a rapidly- changing business landscape depends on the effectiveness of its workplace learning. Since the early 1900s, the prevailing paradigm of industrial engineers within the context of motion and time study (and process improvement) is to find the 'best' way and ensure a right woman/man for a right job. This paradigm has contributed to the need for constant training (as the best way is viewed as a work standard) and professional belief that a worker is replaceable (after prolonged period of training and incentives).

As previously mentioned, a decline in the qualified workforce as well as a viewpoint that training is reactionary underline the shift in the perception of workplace learning (Anselmann, 2022). Apparently, facilitating learning is viewed as essential when managing industrial and business operations, especially when the new waste (or the eighth waste) has emerged for robustness, agility, and resilience (Clardy, 2018). See Figure 1. In the past, there were seven wastes for lean operations (i.e., defects, overproduction, extra-processing, motion, waiting, inventory, and transportation). Recently, the new waste has emerged and is known as the unused or underutilization of talents of the workforce.

Specifically, the most essential talent is the ability to learn. As the knowledge from training and education can be easily obsolete, this ability is deemed to be crucial for long-term business competitiveness and success (Tynjala, 2008; and Rohrer and Harold, 2010).

Figure 1: Unused Talent- Ability to Learn from the Workforce
(Source:https://theleanway.net/The-8-Wastes-of-Lean)

Workplace learning is not only about motivation but also deals with how an individual learns (e.g., human learning). Thus, the research on learning may consist of engineering (e.g., design and construct of feedback), engagement (e.g., emotional intelligence), motivation (e.g., psychological safety), etc (Vollmeyer and Rheinberg, 2005; and Keller, 2010). In addition, how an individual learns needs to incorporate behaviour and feeling since a typical workplace has three types of a worker-engaged, non-engaged, and disengaged. To examine many critical issues on workplace learning, many studies have adapted classroom learning as a surrogate (Violato *et al*., 2008).

Interestingly, a classroom traditionally views the students in three groups- active, passive, and blocked learners. These three classifications in a classroom are similar to those of a workplace. Thus, from this example, an interdisciplinary approach can help industrial engineers maintain organisational competitiveness and business survival in the era of Industry 4.0. In other words, the effects of adapting an interdisciplinary approach for teaching and learning (and development) of future university graduates should be scrutinised and discussed.

Literature review

There is general agreement that the knowledge society will have profound effects on education and how the students learn (e.g., Toffler, 1990; Drucker, 1993; and OECD, 2005). These effects point to an ever-increasing need for lifelong learning and innovation. Performing the work through knowledge was the first step in the so-called knowledge economy with the emerging belief that a worker can acquire

own knowledge through experiences, interactions with peers, and feedback (e.g., OECD, 2005; and Bughin *et al.*, 2018). According to Kilpi (2016), recognizing that work is about gaining or acquiring new knowledge as a worker is faced with an operating environment which is classified as wicked (i.e., volatility, uncertainty, complexity, and ambiguity). One of the outcomes from facilitating learning in a workplace is to develop T-shaped skills for a worker. A T-shaped worker is viewed as an adaptive innovator who appreciates the need to work across various disciplines to complete required tasks. A T-shaped worker is not only a person who creates new products/ services but also solves a complex problem that can affect industrial and business operations (Demirkan and Spohrer, 2018; and Reiter-Palmon *et al.*, 2012).

To achieve effective workplace learning, higher education institutes need to prepare future workforce who are ready for concurrently work and learn at the same time. There is a need to allow the individuals to learn formally and more importantly informally (ILO, 2008). This classroom setting would resemble a workplace which is similarly faced with the pressure from budget constraint, lack of abundant workforce, and work deadlines and requirements. In other words, hands-on experiences through informal learning should be encouraged. Evidently, there is a need to create a learning environment in a classroom that allows collaborative-friendly and connectivity with the actual working environment.

The Z Generation learners (i.e. iGeneration, Centennials, or Generation Z), considered to be those born between the mid-1990s and the mid-2000s, have grown up with the internet, smartphones, and social media as a constant presence in their lives. These learners are diverse, inclusive, and socially conscious due to connectivity. Note that they are more likely to start their own businesses or become freelancers, in addition to working in a company. The expectation of these learners is that they are adaptive (as well as creative and innovative) and can learn quickly under rapidly changing circumstances at their work. The challenge to create a classroom as a workplace needs to incorporate the Self-determination Theory or SDT (Deci and Ryan, 2017). The SDT deals with the motivation which is essential for learning through the feeling of being engaged and connected and having some sort of autonomy. This is important due to the nature of a learning worker. As Reeve (2002) argues, these principles can be applied to educational contexts by creating learning environments that support autonomy, competence, and relatedness, and by fostering a sense of intrinsic motivation among students.

Given the challenge for a firm operating in the era of Industry 4.0 and the need for university graduates to undertake a new way of work (i.e., simultaneous working and learning), many improvement interventions in a classroom based on an interdisciplinary approach have been developed. Specifically, a studio pedagogy is a learning approach that stresses hands-on experiences, experiential learning, informal learning, interaction, and engagement in a studio setting (Kuhn, 2001). A studio environment can facilitate collaborative learning through open space where the learners (or students)

can work on assignments, projects, and experiments together. Critical thinking, problem-solving, peer or community of learning, and constant feedback are some of the common descriptions of a studio pedagogy. This pedagogy is based on the premise that the learners effectively acquire needed/ new knowledge and skills by doing as a learning process is as critical as the result of learning (Schön, 1987).

Oulu University of Applied Sciences' (Oamk) Oamk LABs educational program is an example of an innovative learning environment that serves as a business pre-incubator, designed to educate and foster the development of self-aware professionals and self-directed teams. The Oamk LABs educational program utilises a specific pedagogical model known as the LAB studio model (LSM), which is a form of studio-based learning. This approach emphasises a more practical approach to education, with the objective of developing students' T-shaped skills in a small-group setting. In addition, LSM pedagogy represents an interdisciplinary approach due to the need to understand how an individual learns and how an individual is motivated to learn. Thus, the LSM pedagogy represents an opportunity to modify how the students learn and to help prepare them for the expectation of a workplace. (Heikkinen and Stevenson 2016; and Seppänen *et al.*, 2016).

Objective statement

The objective of this case study is to evaluate the effectiveness of the LAB Studio Model (LSM) pedagogy within the context of learning and motivation to learn among engineering students. Rather than focusing solely on the quality of learning materials and contents, the study aims to explore how such materials can be delivered to enhance essential workplace skills for the future. The study's preliminary assessment of the LSM pedagogy highlights the significance of learning (rather than teaching) and motivation to learn (through a sense of belongingness, autonomy and competitiveness) in preparing university graduates for the demands of Industry 4.0. The findings suggest that the LSM pedagogy is suitable for the current expectations and tasks required in the era of Industry 4.0. Therefore, the study represents a self-reflection on the LSM pedagogy's potential in meeting the requirements of a rapidly- evolving workplace.

Methodology

This study is based on the implementation of the LAB Studio Model (LSM) pedagogy at Oulu University of Applied Sciences' Oamk LABs educational program. Over the study course's existence of five years (2012-2018), more than 600 students participated in over 80 projects and assignments, providing a wealth of data and insights for analysis. By analysing the experiences and outcomes of the students who participated in the LSM pedagogy at Oamk LABs, this study aims to provide valuable insights into the effectiveness of this approach. The large sample size and extensive duration of the

study allow for a comprehensive evaluation of the approach's impact on student learning and motivation to learn.

In the LSM learning setting, the projects and assignments can be described as problem-based learning with a team approach. During the planning and implementation of these projects and assignments, the learners (or the students) actively and openly interact with the faculty staff and the external partners (e.g., customers, users, suppliers, etc.). There is a screening process for suitable projects and assignments, activities on design and development as well as test and evaluation, internal engagement within a team, and external interactions with these partners. Altogether, there are over 600 students who participated in the Oamk LAB's LSM learning setting along with 35 faculty staff and a dozens of partners. In this study, the students are referred to as learners.

After the implementation of the LSM pedagogy, the next step is to conduct observations to better understand its impact on student learning outcomes and motivation. To do so, the study draws upon the LSM methods, as described by Karjalainen *et al.* (2016), which allow for the systematic screening of learning and motivational methods used within the LSM framework. The observations are conducted using a range of parameters, including the frequency and type of feedback provided, group interactions, perceived improvement in learning skills, knowledge acquisition, ability to meet deadlines and requirements, and other factors related to student engagement, trust, and autonomy. Through these observations, the study aims to gain insights into the effectiveness of the LSM pedagogy and identify areas where improvements can be made. By systematically evaluating the various methods used within the framework, the study hopes to provide actionable recommendations for educators seeking to implement similar approaches in their own educational programs.

Findings

The preliminary illustration from the repeated observations over the past five years can be shown as follows. In this illustration, the results from these observations reflect the findings, the impacts, and the changes that have taken place in the LSM within the context of autonomy, competence, and belongingness (or relatedness).

Key takeaway 1: Trust for the teams and individuals during learning activities.

The value of trust refers to the belief that the learners (or students) can do their best to achieve the common goals defined within their team. This leads to trustful and equitable relationships, which extend to the staff as well. During the lessons (i.e., projects and assignments) of LSM, failures and proposed 'mistakes' are communicated clearly being an integral part of learning. Students are encouraged to confront challenges, practice, and discover new solutions after acknowledging their failures. This

approach is deemed effective in cultivating students into independent learners, which are supposed to appear to be more relaxed, engaged, and interactive. In general, this notion is supported by Dweck (2009); Saavedra and Opfer (2012); and Karjalainen *et al.* (2016).

Key takeaway 2: Increasing numbers of self-directive actions.

Significant change has emerged on more self-directive actions by the learners. These actions are derived from more confidence through knowledge and-awareness which are needed when encountering structured and unstructured activities. Successful self-directed actions during learning come from personal interests, feedback, and sense of purpose when completing the projects and assignments. Constant collaboration between the learners and the faculty staff including a formal session which takes place at least once a month strengthens the level of confidence. In addition, the learners are aware of a possibility to organise a special and formal review with the faculty staff.

Key takeaway 3: Becoming more proactive in decision-making instead of waiting for further instructions and solutions

Previous research (e.g., Yip, 2006; and Dierdoff and Rubin, 2015) shows that allowing the learners to become aware of the progress of their work and what they need to perform as their next tasks has positively encouraged more decisions from them and their team members. Conflict management can be handled more easily during project and assignment work. The studio-based environment promotes the acquisition of work-life skills in a supportive atmosphere that tolerates failure, a critical element in preparing individuals for professional life.

Key takeaway 4: Familiarisation with actual work

The studio pedagogy allows the learners to familiarise with open learning space with the ability to utilise available tools and materials to help complete projects and assignments. The LSM pedagogy encourages the learners to utilise available tools and materials instead of providing a problem with pre-determined tools
and materials (Heikkinen and Stevenson, 2016). For project work with digital technology, the use of publicly available software is urged such as internal communications.

For the LSM, the learners are granted free access to the premises 24h / 7 days and have full control over equipment and aesthetic factors. The working space comprises rooms of varying sizes for both project teams and individuals. Each project team is allocated a budget for prototyping materials and testing activities. It is the team's responsibility to plan and manage the use and invoicing of these funds. Although the budget is not overly generous, it covers typical materials required for a prototype.

Key takeaway 5: Blending digital tools for collaborative and participatory learning.

The studio pedagogy stresses the importance of resembling a classroom like a workplace. During the implementation of LSM pedagogy, many digital tools which are commonly used in a company are provided, especially digital learning platforms that facilitate collaborative project work (e.g., documentation & simple design), project communication (e.g., team meetings), work with external clients (e.g., meetings and remote testing) and meetings with teachers (e.g., coaching)). These platforms also provide a means of communication between students and teachers/coaches, allowing participation from outside of a studio. In certain cases, hybrid participation may be utilised, such as in project teams comprising students from different locations and countries.

Key takeaway 6: Feedback as part of informal learning.

The studio pedagogy allows constant feedback within the group of learners. In this context, feedback and evaluation are not the same, since individuals and project teams receive feedback during both formal and informal sessions. Giving and receiving feedback is part of daily activities in the studio classroom. Providing constructive feedback to the learners is viewed as part of learning. By this feedback practice, the learners are able to plan and determine their own learning goals. This is essential a new workplace in which personal development and work are integrated. Also, for the studio pedagogy, feedback reflects coaching, tutoring, and mentoring; in addition to peer-to-peer interactions (Boud *et al.*, 1999).

Key takeaway 7: Integrating uncertainty into classroom settings.

Future professionals require skills such as tolerance for uncertainty, open-mindedness, a willingness to self-correct, and the ability to reach a consensus. These skills are also characteristic of critical thinkers who are motivated to work resourcefully, check for accuracy, gather information, and persist when solutions are not immediately apparent (Halpern, 2007). Critical thinking is closely linked to civic literacy because it uses evidence. The goal of teaching critical thinking is to help students develop their abilities to reason, analyse,
evaluate, and create, and teachers can create a supportive learning environment by acting as coaches who build students' self-esteem and support their personal development.

Key takeaway 8: Professional development derived from problems at hand.

The studio pedagogy allows problem-based learning, which encourages the learners to share and discuss the challenges and problems that they are faced during planning and implementation of their projects

and assignments. Learning by doing (Dewey, 1904) or experimental learning (Kolb, 2014) strengthens hands-on experiences with enhanced problem-solving skills. One of the most critical success factors for this category is the roles of a faculty member from teaching to facilitating learning among the learners. Facilitating involves advice, support problem sharing and awareness among the learners, and encouragement during a difficult period when a solution remains unclear.

Key takeaway 9: Importance of psychological safety and importance of inclusiveness for learning

The studio environment, which allows open working space and free flows of constructive feedback, has resulted in the prevalent feeling of psychological safety. This feeling allows the learners to express their thoughts and feelings openly without any concern of being reprimanded by their peers and faculty staff. Inclusiveness contributes to higher productivity and more efficiency of work and time management among the learners. Feeling togetherness is important not only in a classroom but also for a workplace. This kind of mental environment is beneficial for self-reflection which contributes to the skill of learning.

Key takeaway 10: Importance of coaching for informal learning

Informal learning is recognized as a foundation for workplace learning. One of the most important contributors to informal learning is the ability to coach and to constantly provide feedback to each other in a group. For the LSM pedagogy, there are three types of coaching: role coaching, project coaching, and team tutoring (Karjalainen *et al.*, 2016). Role coaching focuses on specific professional areas, such as business design, with the goal of promoting the learners' professional growth. Project coaching aims to improve project performance by providing help, resources, and guidance through questions, with lead teachers acting as responsible coaches for project teams.

The coach introduces new tools, tasks, and resources, and leverages their connections to assist project progress, with students making decisions about their progress and the coach providing support. At the end of the project, students are asked to grade their own work. Team tutoring promotes better teamwork, covering team goal setting, sharing learning goals, giving and receiving feedback, and workload distribution within the team.

Key takeaway 11: Injecting meaningfulness of work into classroom settings.

A crucial aspect of selecting appropriate problems for project-based learning is that they necessitate an interdisciplinary team. This often leads us to seek out novel business opportunities or tackle wicked problems, where the complexity of the issue requires collaboration across different fields. Thus, one of the most important practices from the LSM pedagogy is the ability to screen and remove poor or mediocre projects and assignments from planning (Heikkinen and Stevenson, 2016). Typically, at the start of learning, a large number of concepts are initiated, from which approximately half are

selected to proceed beyond two pitching events, known as 'Gates'. Due to the two-gate structure, only approximately one out of four of the initial projects presented at the beginning are approved for continuation. This rigorous process is highly significant, as it mirrors the real-world experience of workplace innovation. The impact of this exercise is expected to enhance project management and teamwork skills in a professional setting, ultimately leading to better outcomes in the workplace.

Key takeaway 11: Learning to create knowledge in a stable environment.

Research conducted in a studio environment suggests that stable learning environments can promote the acquisition and retention of knowledge. A study by Heikkinen and Räisänen (2018) found that the socialisation and collaborative problem-solving (Nonaka, 1994; and Nonaka and Takeuchi, 1995) that probably take place in a LSM pedagogy can be highly beneficial for learners. In order to build intellectual capital, it is important for learners to have both internal and external exposure to works in progress.

This means engaging in critical self-reflection and seeking out opportunities for feedback from experts in the field. Such validation can offer valuable insights and guidance for learners, helping to build their confidence and competence. The studio environment promotes socialisation among learners, which can lead to shared problem-solving and co-creation of knowledge. This collaborative approach encourages learners to explore different perspectives and to engage in critical thinking, which can ultimately lead to more innovative and effective solutions.

Key takeaway 12: Attribute of learning derived from building a community of learners.

In a studio pedagogy, the learners (or students), the faculty staff and the partners openly collaborate which is essential for a community of learners (Brown and Campione, 1994) to be formed. Gradually and collectively, the collaboration has positive impacts in learning and a lesson for becoming an active learner. During the planning and implementation of projects or assignments, learning goals and methods are discussed multiple times in an iterative manner.

Building a community of learners through a gradual and trusted manner helps to reduce the boundary and personal bias from the learners who can have different educational backgrounds and experiences (Akkerman and Bakker, 2011). Projects and assignments that deal with customer expectations and requirements need the learners to work collaboratively. Within this community, learning goals can be collectively developed and discussed which contribute to the ability to meet or achieve the deadlines (of projects and assignments). Developing learning goals among the learners is fundamental for a workplace when they graduate.

Discussion

The discussion focuses on the 12 key takeaways and their relationship with learning and the motivation to learn. These two issues are critical for a future workforce as there is a need to overcome the unused talents in a workplace for the era of Industry 4.0. How an individual learns is important for a future workplace. From the experiment with the studio pedagogy, there are many key takeaways from the repeated observations which include psychological safety, safe learning environment, open space, constant feedback, informal learning, etc.
Many developments have taken place over the experiment such as the ability to set self-learning goals, the willingness to share and transfer knowledge, the openness to discuss problems, etc.

There appears to be significant implications on learning and motivation to learn. In a studio environment, incorporating the work- life approach in the pedagogy paves a way for openness, trust, and partnership development. The work-life approach encourages the learners to think critically and creatively, developing their problem-solving skills by engaging them in open-ended projects that require them to apply their knowledge in real-world contexts. By doing so, students are prepared to tackle the challenges they will encounter in their future careers. Ultimately, the work-life approach helps bridge the gap between education and the workforce, making the learners more aware of the practical applications of what they learn in the classroom.

To strengthen how an individual learns, autonomy through constant feedback and informal learning cannot be overlooked. In this study, autonomy is the degree to which an individual has the power to control their work schedule, tasks, and responsibilities. By providing more autonomy, the learners are empowered to make decisions that impact their project and individual performance within that project. In a professional learning context autonomy could be increased in learning by the roles of a faculty staff as a facilitator of learning (like a coach, a mentor, and a supporter), the sense of belongingness through a community of learners, and the sense of psychological safety (through a creation of safe learning environment).

The studio pedagogy allows the learners to develop competency and skills through reflection, feedback, and problems at hand. Tailored learning, similar to a private firm on customization, is important for future learning and development of an individual. This underlines a changing viewpoint on training (as a reactive response) which shifts towards more learning (representing a more active response to a future workplace). Trust from open working space through informal learning also strengthens many employability skills such as communication, problem solving, team building (in a group environment), etc.

Another significant implication, based on the implementation of the studio pedagogy, is the importance of belongingness (or relatedness). The motivation to learn apparently depends largely on the sense of belongingness. Meaningful relationships among the learners within a project team or community is essential for the motivation to learn. This is due to a challenge or a problem that is an integral part of learning when undertaking projects and assignments.

The studio environment also encourages communication and partnership with less control from the faculty staff and participation from the partners. Interestingly, by focusing on the theory-practice connection (i.e., the relationship between the theoretical concepts and principles learned in a classroom or academic setting and their practical application in real-world situations), this helps bring meaningfulness to the learners in a way that they don't feel a barrier or a bias due to the differences in educational background and experiences.

Conclusion

This study is based on the implementation of the LAB Studio Model (LSM) pedagogy within the Oamk LABs educational program at Oulu University of Applied Sciences. The study draws on a wealth of data collected over a five-year period, spanning from 2012 to 2018. During this time, more than 600 students participated in over 80 different projects and assignments, providing a rich and diverse range of experiences and perspectives to draw upon. The aim of the study is to explore the aspects contributing to individual learning and motivation to learn during the period of her/his studies in LSM. After the repeated observations, there are 12 important key takeaways which have contributed to learning and motivation to learn. Further investigations are needed to help verify and validate these initial findings and their lasting impacts on the skills of learning which is essential for a workplace in the era of Industry 4.0.

REFERENCES

Akkerman, S. F., & Bakker, A. (2011). Boundary Crossing and Boundary Objects. *Review of Educational Research,* 81(2), 132–169.

Anselmann, S. (2022), "Trainers' learning conditions, informal and formal learning and barriers to learning", *Journal of Workplace Learning*, Vol. 34 No. 8, pp. 742-764.

Argyris, C. (1991) "Teaching smart people how to learn", *Harvard Business Review*. Vol. 69, No. 3, pp. 99- 109.

Boud, D., Cohen, R., & Sampson, J. (1999). Peer learning and assessment. *Assessment & evaluation in higher education*, 24(4), 413-426.

Brown, A. L., & Campione, J. C. (1994). *Guided discovery in a community of learners*. The MIT Press.

Bughin, J., Hazan, E., Lund, S., Dahlström, P., Wiesinger, A., & Subramaniam, A. (2018). Skill shift: Automation and the future of the workforce. *McKinsey Global Institute*, 1, 3-84.

Clardy, A. (2018) "70-20-10 and the Dominance of informal learning: a fact in search of evidence", *Human Resource Development Review*, Vo.17, No. 2, pp. 153- 176.

Demirkan, H., & Spohrer, J. C. (2018). Commentary—cultivating T-shaped professionals in the era of digital transformation. *Service Science*, 10(1), 98-109.

Dewey, J. (1904). The relation of theory to practice in education. *Teachers College Record*, 5(6), 9-30.

Dierdorff, E. C., & Rubin, R. S. (2015). We're not very self-aware, especially at work. *Harvard Business Review.* Retrieved from https://hbr.org/2015/03/research-were-not-very-self-aware-especially-at-work.

Drucker, P. F. (1993). The rise of the knowledge society. *The Wilson Quarterly,* 17(2), 52-72.

Dweck, C. S. (2009). Mindsets: Developing talent through a growth mindset. *Olympic Coach,* 21(1), 4-7.

Gomes, C., Kruguanska, S., Gouvea, I., Madruga, L., and Schuch, V. (2015) "Conditioning factors for learning-oriented organizations", *International Journal of Innovation and Learning*, Vol. 17, No. 4, pp. 453-469.

Halpern, D. F. (2007). *The Nature and Nurture of Critical Thinking.* Cambridge University Press.

Heikkinen, K. P., & Räisänen, T. (2018). Role of Multidisciplinary and Interdisciplinary Education in Computer Science: A Literature Review. *Managing Global Transitions,* 16(2), 159-172.

Heikkinen, K.-P., & Stevenson, B. (2016). The LAB studio model: enhancing entrepreneurship skills in higher education. *International Journal of Innovation and Learning*, 20(2), 154–168

ILO (International Labour Office). (2008). Skills for improved productivity, employment growth and development. In Report V, *International Labour Conference,* 97th Session.

Johnson, S., Blackman D., and Buick, F. (2018) "The 70:20:10 framework and the transfer of learning", *Human Resource Development Quarterly*, Vol. 29, No. 4, pp. 483- 402.

Karjalainen, J., Seppänen, U. M., & Heikkinen, K. P. (2016). Oamk LABs practices for bridging work life 21th century skills and higher education. *UAS Journal, Journal of Finnish Universities of Applied Sciences*, EAPRIL Special Issue. Retrieved from https://uasjournal.fi/in-english/oamk-labs-practices-for-bridging-work-life-21th-century-skills-and-higher-education/.

Keller, J. (2010). "*Motivational design for learning and performance: The ARCS model approach*", Springer, New York.

Kilpi, E. E. (2016). Perspectives on new work: Exploring emerging conceptualizations. *Sitra Studies*, (114).

Kluger, A., and DeNisi, A. (1996) "The effects of feedback interventions on performance: a historical review, a meta-analysis, and a preliminary feedback intervention theory", *Psychological Bulletin*, Vol. 119, No. 2, pp. 254-284.

Kolb, D. A. (2014). *Experiential learning: Experience as the source of learning and development*. FT press.

Kuhn, S. (2001). Learning from the architecture studio: Implications for project-based pedagogy. International Journal of Engineering Education, 17(4&5), 349–352.

Masood, R. and Pareto, L. (2021) "Workplace work-integrated learning: supporting industry 4.0 transformation for small manufacturing plants by reskilling staff", *International Journal of Lifelong Education*, Vol 40, No. 1, pp. 5-22.

Organisation for Economic Co-operation and Development, OECD (2005). *The definition and selection of key competencies: Executive summary.* Retrieved from https://www.oecd.org/pisa/35070367.pdf.

Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization Science*, 5(1), 14–37.

Nonaka, I., & Takeuchi, H. (1995). *The knowledge-creating company: How Japanese companies create the dynamics of innovation.* New York: Oxford University Press.

Reeve, J. (2002). Self-determination theory applied to educational settings. *Handbook of self-determination research,* 2, 183-204.

Reiter-Palmon, R., Wigert, B., & de Vreede, T. (2012). Team creativity and innovation: The effect of group composition, social processes, and cognition. In *Handbook of organizational creativity* (pp. 295-326). Academic Press.

Rohrer, D., and Harold P. (2010) "Recent Research on Human Learning Challenges Conventional Instructional Strategies." *Educational Researcher*, Vol. 39, No. 5, pp. 406–12.

Ryan, R. and Deci, E. (2017), "*Self-determination theory: Basic psychological needs in motivation, development, and wellness*". Guilford Publishing, New York.

Saavedra, A. R., & Opfer, V. D. (2012). Learning 21st-century skills requires 21st-century teaching. *Phi Delta Kappan,* 94(2), 8-13.

Schön, D. (1987). *Educating the Reflective Practioner.* San Francisco: Jossey-Bass.

Seppänen, U.-M., Heikkinen, K.-P., & Stevenson, B. (2016). Oamk LABs. In D. Remenyi (Ed.), *Innovation & Entrepreneurship Teaching Excellence Awards - An Anthology of Case Histories* (pp. 111–126). Reading: Academic Conferences and Publishing International.

Toffler, A. (2022). *Powershift: Knowledge, wealth, and Power at the Edge of the 21st Century*. Bantam.

Tynjala, P. (2008) "Review: Perspectives into learning at the workplace", *Education Research Review*, Vol. 3, pp. 130-154

Violato C, Lockyer J, Fidler H. (2008) "Changes in performance: a 5-year longitudinal study of participants in a multi-source feedback programme", *Medical Education*, Vol. 42, No. 10, pp. 1007–1013

Vollmeyer, R. and Rheinberg, F. (2005) "A surprising effect of feedback on learning", *Learning and Instruction*, Vol. 15, No. 6, pp. 589- 602.

World Economic Forum (2020). *The future of jobs report 2020.* Retrieved from https://www.weforum.org/reports/the-future-of-jobs-report-2020/.

Yip, K. S. (2006). Self-reflection in reflective practice: A note of caution. *British Journal of Social Work*, 36(5), 777-788.