Learning in the Year 2030

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Upload Knowledge to Your Brain

Researchers from the California-based HRL Laboratories developed an innovative way to make learning quicker and more effective by neuro-stimulation. They use a headset to feed electric signals from the brain of an experienced airplane pilot to the brain of trainees. HRL Laboratories claim that by this new technology, trainees learned how to pilot airplanes in a flight simulator 33 percent better than non-stimulated candidates did. Transcranial direct current stimulation (tDCS) has become the latest fad in learning settings this year. Researchers argue that tDCS strengthens synaptic connections and thus enabling faster learning. Sales of DCS starter kits (called Halos), which contain cables, electrodes, straps, batteries, sponges, and a current stimulator, are booming. Biomedical engineering expert Monica Werner, however, warns that it is not enough to just to put on a neuro-stimulation headset and hope to master a musical instrument or improve your golf handicap. You still need to practice, but researchers argue that the device will assist your brain to memorize and supports a quicker creation of synapses.

1 Introduction

Hoping that we can upload knowledge while sleeping and wake up enlightened is still a dream in 2030. What, how, when, and where we learn, however, is changing rapidly. While there is a widespread discussion about which skills and competencies will be needed in the 2030s, there is an overall education and learning challenge: To develop “agency.” As EAEA (2019) states, agency—the ability to make informed choices about one’s life and a sense of responsibility to participate in the world and
to influence people, events, and circumstances—is at the center of learning and, consequently, of any change in society. In their Education 2030 report, OECD (2018) argues that two factors, in particular, help learners enable agency: “The first is a personalized learning environment that supports and motivates each student to nurture his or her passions, make connections between different learning experiences and opportunities, and design their own learning projects and processes in collaboration with others. The second is building a solid foundation: literacy and numeracy remain crucial. In the era of digital transformation and with the advent of big data, digital literacy and data literacy are becoming increasingly essential, as are physical health and mental well-being.”

As boundaries between remunerated work, voluntary activity, and leisure blurred, the same thing happened to the learning spans across these activities. Do you remember that 10 years ago, learners sat in rows in classrooms? Today, people learn in a museum setting, out in nature, and together with robots in a factory or other places. Students know to break up the rows of chairs to create pods and place themselves around the room or join in a multidisciplinary superlab. “Learning everywhere” by choosing the time, place, media, and content that best meet the learners’ goals, intentions, and wishes has become a reality.

In work contexts, learning and performance management are increasingly linked. This is supported by on-demand (micro)learning, often supported by virtual reality applications. “Mass-personalization” of content and delivery modes address and engage learners individually. Data-driven identification of learning gaps is the basis for creating personalized learning experiences based on open education resources available on mobile devices. The learning experience platform (LXP) market is growing up fast, which makes the content easy to find and consume. Face readers, eye trackers, and wearables help learners to show and develop appropriate learning strategies and behavior. Gamification links emotions to learning. In 2030, self-directed and social learning has gained in importance over standardized institutional learning programs. Synchronizing human and machine learning is still a problem to be solved.

In the following chapter, we will discuss the state of the art of adult learning in the fourth decade of the twenty-first century. While this contribution mainly focuses on work-related learning, many of the developments discussed are pervasive in all spheres of education and learning.

2 Learn-Work-Live: Lifelong Learning Has Become a Reality

The shift toward knowledge work, artificial intelligence, digitalization, and robotics will definitely disrupt our classical stages of life and our workplace in profound ways. It will make it much more fluid and thereby interesting. In 2030 education and training, work-life and career followed by (partial or temporary) retirement will no longer be separated stages but much more intertwined. Therefore, we will have to organize these three stages in a fundamentally new and more synchronized way.
Lifelong career guidance centers on-site, for example, in shopping malls or as online platforms will assist citizens in shaping their career life.

In the past, it was common to have one job and one professional career. The US Bureau of Labor Statistics (2019) found out that “individuals born in the latter years of the baby boom (1957–1964) held an average of 12.3 jobs from ages 18 to 52.” These numbers are expected to increase for millennials (born between 1995 and 2010) and require them to renew their professional expertise during that time. These phases are interrupted by further education, not just reading a book or attending a two-day seminar, but rather a fundamental overhaul and renewal of knowledge and skills. Figure 1 illustrates this need for lifelong learning as relevance and validity of knowledge decrease rapidly. Learning becomes “fluid” throughout our lives.

Under the concept of “Fluid learning,” Falconer et al. (2013) describe the radical change in cultural perceptions of learner agency and learner-teacher roles, associated with changes in technology: “After completing compulsory education, the focus of each learner moves from learning pre-defined knowledge to filling gaps between areas of knowledge, integrating different areas of expertise, as well as learning new knowledge. People do not turn automatically to formal institutions for large blocks of learning. Instead, they consider it natural to make use of open learning resources and open courses, making their own decisions about what to learn, when and how. Learners naturally employ open learning practices, creating new knowledge for future learners to benefit from. They expect to contribute to the learning of others as well as learning themselves, viewing themselves as the experts in their own situation.”

Bélanger (2016) widens the term of “lifelong” to “lifewide” learning which comprises learning in institutions, families, communities, and workplaces.

Fluid and lifewide learning imply that people take responsibility for self-organized learning and manage their competence portfolio by blending formal and informal learning. This also raises the question of how to finance lifelong learning (ILO 2018). In 2030, many increasingly flexible financing instruments such as vouchers and individual learning accounts (ILA) will give learners the freedom to make training rights “portable” from one job or employment status to another or
allocate funds to the learning provider of their choice. In ILA, learners and employers deposit funds for competence development. Accumulating assets in the learning account would allow learners to defer taxes (OECD 2019; Oosterbeek and Patrinos, 2008). By 2030, instruments like Singapore’s SkillsFuture Credit will become widespread.

Singapore’s SkillsFuture Credit

“As part of efforts to encourage Singaporeans to take ownership of their skills development, a one-off SkillsFuture Credit top-up of $500 will be provided to every Singapore Citizen aged 25 years and above. Eligible Singaporeans can start using their one-off SkillsFuture Credit top-up on more than 8000 courses offered by the Institutes of Higher Learning (IHLs) and NTUC LearningHub and also on other SkillsFuture Credit-eligible courses. Take timely action to upskill and reskill, to seize new career opportunities! This top-up will expire on 31 Dec 2025.”

Source: https://www.skillsfuture.sg/Credit

3 People Take Responsibility for Self-Regulated Learning and Manage Their Competence Portfolio

What has been your learning journey so far? Was it characterized mainly by being a consumer of formal education? Or have you gained experience with self-organized learning and managing your competence portfolio?

In switching to self-organized learning, you might need to overcome two challenges: “the extent to which learners need guidance and, depending on the learning goals, the extent to which learners need recognition and certification” (Castaño Muñoz et al. 2013, p. 171).

Depending on the needs and personality of the learner, Castaño Muñoz et al. (2013) suggest four complimentary scenarios of open adult learning. The learning for life scenario is based on the learner’s interests and curiosity without a need for formal recognition. Learners select learning resources according to their needs with no or a minimum of guidance. In case learners seek more guidance, orientation, and structure, in often confusing and in transparent training market, learners would rely more on assistance by communities and groups or on trusted gateways to knowledge (learning café scenario). My learning certified scenario responds to the need for recognition or certification to fulfill an externally set curriculum or standard. In this scenario, learners might still have a high degree of freedom regarding learning resources and approaches. The open training scenario lies between the learning café and my learning certified approach: “Here the learner chooses to study a particular subject that is linked to an externally set standard (even if this is loosely defined) in a more structured, supportive, collaborative learning environment. This
scenario may lead to a certification, but the latter is not necessarily its principal aim” (Castaño Muñoz et al. 2013, p. 176).

To support these scenarios, self-regulated learning is increasingly assisted by adaptive learning systems with AI-based tutors that are powered by algorithms to customize individual learning journeys. In personalized scaffolding, artificial tutors “provide successive levels of temporary support that help learners reach higher levels of comprehension and skill acquisition that they would not be able to achieve without assistance. Like physical scaffolding, supportive strategies are incrementally removed when they are no longer needed” (so-called fading scaffolds) (www.edglossary.org/scaffolding/). In such a system, there might be four tutors or “agents”: “Gavin the Guide” supports students’ navigation in the learning environment and provides questionnaires for self-assessment. “Pam the Planner” monitors the planning process during self-regulated learning and helps users to set sub-goals or to activate their preknowledge. “Mary the Monitor” presents the meta-cognitive monitoring of self-regulation during learning by stimulating self-assessments on text comprehension or estimated sub-goal achievement. “Sam the Strategizer” encourages cognitive learning strategies (Azevedo et al. 2016).

As learning broadens, so too must assessment and accreditation. Assessment is performed by a range of different types of people, including peers and experts, not just by teachers. Open technologies offer new means of accreditation through expert consensus and/or online activity tracing on mobile devices (Falconer et al. 2013).

In 2030, a variety of formal or informal certifications are available. This is especially useful as regards competencies that are not recognized in frameworks or official curricula. Micro-credentials, badges, and social certification are widely spread, making it difficult to understand how valid these certifications are. There is an increasing number of organizations and firms offering the management of e-portfolios. As an example, the box below explains the Open Badge concept of the Mozilla Foundation. To verify resumes and competence profiles, blockchain protocols allow for the creation of personal profiles that certify academic credentials, participation in nonacademic training courses, skills, previous work experience, and recommendations received. This is what the start-up Skillchain proposes.

In 2030, personal trusted portfolios, where individuals can store and manage their own “demonstrators” of competences, are common. Professional platforms such as LinkedIn are trying to develop their business as “human capital banks.” Competence portfolios are increasingly generated automatically by analyzing the “digital footprint” of users across digital media and applications. Even though these applications claim that users have full command of their competence portfolio, there is some doubt if these systems can be trusted and privacy is respected. Courses on “What skills, competencies, and experiences do you share online?” and how “Do you ‘showcase’ your talents?” have become popular in 2030. Consequently, the monopoly held by the public sector in certification is fading or has become more flexible and open.
Open Badges
Open Badges promoted by the Mozilla Foundation are verifiable, portable digital badges with embedded metadata about skills and achievements which can be shared via the web. They represent a continuously updated picture of a person’s lifelong learning. Each Open Badge is associated with an image and information about the badge, its recipient, the issuer, and any supporting evidence. All this information may be packaged within a badge image file that can be displayed via online CVs and social networks. Badges may represent many different types of achievements and claims: Hard skills such as proficiency in a programming language, soft skills like collaboration, official certification, community involvement, and new skills and literacies not recognized by traditional education providers.

Because the system is based on an open standard, recipients can combine multiple badges from different issuers to tell the complete story of their verifiable achievements—both online and off-line. Open Badges can be displayed wherever recipients want them on the web, including on social media profiles and through services that store and display badges. Badges can be shared for employment, education, or lifelong learning.

Anyone can issue a badge, receive one, verify that a badge is real, or inspect the metadata and any associated evidence. Badge issuers can certify that their badges are technically compliant with the specification and, therefore, can be readily moved among backpacks and display sites. Badges can be used to set goals, motivate behaviors, connect learning environments, and communicate achievements across many contexts.

Source: https://openbadges.org

4 How We Learn in 2030

In 2030, people do not only take responsibility for self-regulated learning, but also how and where we learn has changed significantly. That is why on-demand learning and microlearning, combined with action, have become the primary learning approach, often linked to performance analytics. People bring their own devices (BYOD) and increasingly rely on virtual or augmented reality applications. On-demand learning suits in particular freelancers who change jobs frequently and combine different projects at different organizations.

Let us have a look at how learning has become more attractive, relevant, and up-to-date.

Learning on Demand Combined with Action
In the past, people often had the feeling that they were forced to learn things that they will never need. The current generation of learners wants to be able to solve
problems now and demand personalized content in real time, anywhere and anytime. This immediacy has changed people’s expectations of learning and is challenging traditional learning and development structures in organizations that take too long to respond. Haenisch (2017) describes modern learning on demand (LoD) systems as follows: LoD enables continuous learning in small nuggets to enable immediate action or to stay current with the ever-changing knowledge required. From your app where you perform a certain task, you may directly jump into learning about this task if needed. You can ask a “learning bot” what you want to know “and the bot puts together a great explanation out of the myriads of content available, tailored to your pre-knowledge and preferred learning style. Moreover, it won’t be only about you asking questions. The bot might reach out to you and pro-actively inform you about new things you should learn” (Haenisch 2017). As a learner, you might have access to a learning experience platform (LXP) that looks more like YouTube or Netflix to search and select relevant content. In addition, interactive labs and clinics create environments for teams to learn together close to work situations.

When learning comes closer to action, it is only one step further to link it to performance management. Analytics about learners, programs, and experiences link learning with individual, team, and organizational performance. In 2030, comprehensive learning analytics allow us to optimize learning based on data about learners, learning experiences, and learning programs. Learning and development (L&D), HR professionals, and operational management have overcome their relative isolation from each other, which was still the case in the 2020s.

### Linking Learning and Performance

“A manufacturing company seeks to increase efficiency across their supply chain, as measured by the number of rush orders. Through the performance management process, managers set relevant goals for supply chain team members, assign training to streamline their processes, and track performance after training. If rush orders drop, the learning was a success. By setting a clear metric (number of rush orders) that speaks to a business goal (supply chain efficiency), the L&D team can work with managers (who lead the performance process) to deliver the right training to the right individuals.”

[https://www.peoplefluent.com/blog/learning/linking-learning-performance-management-drive-business-outcomes/](https://www.peoplefluent.com/blog/learning/linking-learning-performance-management-drive-business-outcomes/)

### Microlearning

With shorter attention spans and the pressure for quick and ubiquitous learning, short digital lessons that workers can access at their convenience have become popular. Microlearning consists of short, focused learning nuggets designed to meet a specific learning outcome, typically designed and delivered in rich media formats. Often,
augmented or virtual reality solutions allow to closely link training and real situations. In healthcare, for example, a display of organs via holograms can support surgeons to prepare for complicated operations.

These flexible, portable, and personalized microlessons give learners the freedom to choose to learn wherever is convenient. “Breaking up content into microlessons increases learning outcomes, makes it easier to author and also easier to engage with. The method is most effective on specific tasks or to rapidly fill performance gaps.”

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**Microlearning with Virtual and Augmented Reality**

Vanessa is a junior labor inspector and wants to get fit for inspecting a specific kind of ship. On her tablet, she opens the “The Maritime virtual tour,” which is a virtualization of a ship to guide labor inspectors on a maritime deck. She puts on her virtual reality glasses for an immersive learning experience with simulated real-life situations on a ship. She virtually goes through all kind of default situations an inspector could encounter (FOL 2018).

Marc operates a machine in an Industry 4.0 setting. In the morning, when he signs in at the control panel of the machine, he is regularly offered short learning nuggets to deepen or update his knowledge on specific operations. He can only start operations after having gone through the learning nugget. When the machine asks for a maintenance operation, he scans a QR code on the machine with his tablet, directs the camera to spot where maintenance is needed, and is guided by an augmented reality solution, where the real-world image is overlaid by virtual information with example maintenance instructions.

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**“No Thrill-No Skill”: Games to Learn**

Daniel starts his first day in a customer care team by a gamified onboarding training to help him acclimatize with the culture of the organization. The game uses virtual reality (VR) features, personalization through avatars, and leaderboards and analytics to understand the efficacy of user interactions.

Gamification builds on people’s natural desires for socializing, fun, mastery, competition, achievement, and status. The main strategy to keep players engaged is to reward them by points, badges, or levels and compare players in a competitive environment.

Kapp (2012, p. 10) defines gamification as “using game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning, and solve problems.” In social networks, where reward and status elements are embedded in implicit and explicit forms in people’s interactions, game elements and competition are interspersed throughout the platforms. In the 2030s, gamification has shifted toward the construction of open gameworlds, which are 3D immersive locations that players can explore. In 2030, gamification software can understand each user and provide him or her with a tailored experience (Growth Engineering 2018). Pervasive games that extend the gaming experiences out into the
physical world by weaving the games into the fabric of players’ real environments are increasingly applied as serious games in work contexts. Readers looking back from 2030 might remember the game Pokémon Go which was popular 15 years ago.

**Pulse!!: Serious Gaming in Healthcare**

“Pulse!! reproduces the conditions of an emergency ward in a hospital. Thanks to this video game, future nurses can practice all they have learned in their theoretical classes and gain experience handling real situations. The goal of the players is to identify each patient’s problem, giving priority to the most severe cases, and applying the appropriate measures depending on each person’s condition.”

Source: [https://www.game-learn.com/all-you-need-to-know-serious-games-game-based-learning-examples/](https://www.game-learn.com/all-you-need-to-know-serious-games-game-based-learning-examples/)

**Learning Is Social and Open**

Learning has always been a social phenomenon in the family and at school, work, and society at large. Professional networks of colleagues and contacts have been an essential source for workplace learning. The last 10 years, however, have leveraged learning via social media applications, where learners network, share, collaborate, and exchange ideas to solve problems. Simulations take learning closer to real-world events. Tools such as (micro)blogs, wikis, Twitter, interactive instant messaging, YouTube or “Edutube” channels, podcasts, and social bookmarks or social tagging have become important sources so that everybody can become a content provider and a consumer of learning resources. Since the 2020 Covid-19 crisis, platforms for webinars and live presentations are blossoming. Increasingly popular are formats like “radio talk show,” a free web-based service in which anyone can create, join, or listen to live interactive content. Talk shows can be recorded, making them available as podcasts later. Social networks like LinkedIn or Facebook have developed new business as learning providers.

*The open education movement* offering OpenCourseWare, MOOCs, and Open Educational Resources (OER), in general, has become a central player in the education market. There are a plethora of learning and research materials available in any medium, digital or otherwise. These mostly “reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation, and redistribution by others with no or limited restrictions” (UNESCO no year).

**Agile Learning via Communities**

As many subject areas develop rapidly, quick learning loops are imperative. Sara is a part-time manager of a specialist community in healthcare. The community provides constantly updated training modules and certifies their users for skill blocks. The community started with the exchange and informal (continued)
learning on a new topic in an informal setting of an online group space on a social media platform. Resources and materials on the subject area were collated (e.g., individual problem solutions, brief experience reports, visualizations on relationships). In the next step, resources and materials were systematized by the community manager or learning coach and made available to other users (e.g., intranet pages on the topic, webinars, podcasts, interactive tutorials). Sara also ensures the quality of the materials (inconsistencies, gaps). These quality-assured materials are an important basis for the development of training units and, if necessary, certifications (peer-to-peer assessments) on the new topic for larger target groups. Thus, learning from colleagues becomes more agile, relevant, and up-to-date than the traditional development of training programs.

5 Human and Machine Learning Are Increasingly Integrated

In 2030, the applications of “augmented intelligence” have changed a broad spectrum of domains, such as medicine, science, finance, and security intelligence. People train machines, learn from and with machines, explain their outputs, and ensure their responsible use. Wilson and Daugherty (2018b) call this reciprocal apprenticing: “In the past, technological education has gone in one direction: People have learned how to use machines. But with AI, machines are learning from humans, and humans, in turn, learn again from machines. In the future, humans will perform tasks alongside AI agents to learn new skills, and will receive on-the-job training to work well within AI-enhanced processes.” For these tasks, new jobs as “machine trainers” emerge.

Machine-learning algorithms must be taught how to perform the work they are designed to do and how to best interact with humans. This requires understanding the two fundamentally different ways in which machines learn. In the symbolic reasoning approach, being supervised or unsupervised learning, developers encode and store knowledge in a knowledge base to solve tasks, drawing rule-based inferences from that knowledge. This form of machine learning is close to experience-based human learning and applied to, e.g., robots learning to interact with humans. The key advantage of symbolic learning is that the reasoning process can easily explain why a particular conclusion is reached and what the reasoning behind each of the steps had been. Codifying knowledge, however, requires substantial effort, and inference rules become increasingly complex with the breadth of the knowledge domain, which restricts these systems’ capabilities. For these tasks, new jobs as “machine trainers” emerge, which often include interdisciplinary teams.
Training of Chatbots

“Microsoft’s AI assistant, Cortana, required extensive training to develop just the right personality: confident, caring, and helpful but not bossy. Instilling those qualities took countless hours of attention by a team that included a poet, a novelist, and a playwright. Similarly, human trainers were needed to develop the personalities of Apple’s Siri and Amazon’s Alexa to ensure that they accurately reflected their companies’ brands. Siri, for example, has just a touch of sassiness, as consumers might expect from Apple.”

Source: Wilson and Daugherty 2018a, p. 5

In deep learning, on the other hand, systems perform tasks using statistical models “filtering” data in neural networks with several layers. This happens, for example, in face recognition and is applied, for example, to cancer screening. Developers optimize/train these models by extracting patterns from data of solutions to similar past problems or by letting the system gain experience from the feedback over time. The high performance of deep learning methods comes at the cost of high model complexity and low interpretability. Artificial neural networks’ complexity usually prohibits determining why a system based on such models has reached a specific solution (Berger and Hess 2019).

Based on this understanding of how machines learn, the following six challenges for effective learning of humans together with machines will be discussed:

Narrow application challenge: “Most current AI systems are ‘narrow’ applications—specifically designed to tackle a well-specified problem in one domain, such as a particular game. Such approaches cannot adapt to new or broader challenges without significant redesign. While it may be far superior to human performance in one domain, it is not superior in other domains” (CSER 2020). Users of such systems have to be trained within which limits specific systems will deliver good results and what happens if these limits are surpassed.

Dependency challenge: While many people are no longer able to find their way without their car navigation system, professionals in 2030 are increasingly dependent on AI applications. Will a surgeon be able to operate without the help of AI systems? Will a pilot be able to land an airplane when algorithms fail? This increasing dependence on such systems requires developing strategies to learn, simulate, and regularly practice interaction with these systems to understand how they “tick” and how to act when systems fail.

Value alignment challenge: Norbert Wiener, the founder of cybernetics, had already stated in 1960 that “We had better be quite sure that the purpose put into the machine is the purpose which we really desire.” To avoid misalignments between human and machine goals, algorithms have to be trained, and their behavior has to be closely monitored. This is an arduous task as human behavior is rooted in values and norms, which are mostly implicit knowledge. There is also a need for awareness training on the ethics of algorithms.
Bias challenge: This is a specific problem related to value alignment as algorithms may be trained on data containing human bias. Unfair machine-learning algorithms may reinforce social biases of race, gender, sexuality, and ethnicity. Examples are face recognition systems reflecting societal prejudices or biases in personnel selection or credit allocation algorithms. By 2030, developers and users have become aware of these possible biases and learned to mitigate them.

Black box challenge: The high performance of deep learning methods comes at the cost of high model complexity and low interpretability. Artificial neural networks’ complexity usually prohibits determining why a system based on such models has reached a specific solution. Building and training accountable and interpretable AI-based systems are therefore a crucial task in fusing human and machine learning. This should be governed by the principle of algorithmic transparency. This principle refers to the transparency of factors that influence the decisions made by algorithms to the people who use, regulate, and are affected by systems that employ those algorithms. The Boeing 737 Max crashes around 2020 demonstrated the vital need that users are trained to understand how an algorithm reasons.

Competitive pressure challenge: The “launch and iterate” mindset in software development might lead to deficient testing and training due to time constraints and cost reduction pressure. Boeing, for example, wanted to avoid costly simulator training of pilots for the 737 Max resulting in reduced capabilities in using the Maneuvering Characteristics Augmentation System. It is evident that an efficient learning journey of developers and users is compulsory in particular for such critical systems.

Microsoft’s 18 design guidelines for human-AI interaction (see Fig. 2) not only are valid for developers but also provide useful guidance for integrating human and machine learning, and this may provide answers to some of the challenges mentioned above.

6 Implications for the Stakeholders of Learning in the Year 2030

The developments discussed above lead to far-reaching changes not only for learners but also for the involved stakeholders, which will be described in the following.

1. As a learner, you take responsibility for self-organized learning and manage your competence and skill portfolio by blending formal and informal learning. You proactively set your learning goals and create your learning journey making the best use of digital tools and devices. If necessary, seek support by a learning coach or your personal AI-powered chatbot. Integrate yourself into communities and networks to benefit from sharing knowledge and experiences with peers. Collect your “badges” and certificates to prove and communicate your competencies and skills.
Fig. 2 Microsoft’s 18 design guidelines for human-AI interaction. Source: https://docs.microsoft.com/en-us/ai/guidelines-human-ai-interaction; see also Amershi et al. (2019)
2. **As a manager**, you pay less attention to degrees while hiring new employees/knowledge workers. Instead, focus more on competencies and values/attitudes to cope with complexity, uncertainty, and ambiguity. Such competencies include creative and critical thinking, problem-solving, collaboration, empathy, self-leadership, and the ability to learn on-demand since the shelf life of skills will be even shorter (OECD 2016).

3. **As learning and development (L&D) or human resource (HR) manager**, you integrate learning into the workflow and measure the outcomes of learning on performance. Ensure that data-driven and personalized learning platforms provide employees with relevant content and individualized learning solutions ready for application. “This is a win-win situation: employees grow their portfolio of skills and apply themselves in different roles and networks, enriching their experience, while companies can reach their goals and constantly grow thanks to highly skilled in-house talent” (Rallyware 2020).

4. **As an educator**, you act as a trusted guide and learning coach to create and accompany relevant and fulfilling learning experiences. More specifically, you
   - assist in developing personal learning goals and how to measure results and support the relevant self-assessments of the learner;
   - assist in defining individual learning path and help to identify and make available relevant content and resources;
   - coach learning groups, moderate interaction on learning platforms, and facilitate peer-to-peer learning and co-creation;
   - provide guidance/coaching for critical thinking and reflection on competencies developed as well as on the learning process.

5. **As a tutor bot**, you do not only ask and answer questions but also provide personalized scaffolding. You promote problem-solving by encouraging learners to find answers on their own. As tutor bot, you energize your learners and assist them with learning resources. You also give learners regular feedback. You also act as a sparring partner: Before learners take an assessment, they can engage with a tutor bot to test their knowledge.

6. **As a learning curator or learning designer** (instructional designer), you identify the competence and skill gaps of a targeted audience and create, select, and suggest learning experiences that close this gap. You research applicable content, suggest and formulate course materials, and then collate these newly designed resources. You also enable learning via online communities and social media technologies, curating content and providing guidance to faculty and teaching experts.

7. **As a machine trainer**, you teach machine-learning algorithms on how to perform the work they are designed to do and how best to interact with humans (Wilson and Daugherty 2018a). You also simulate use cases and train professionals to work with these AI-powered systems.
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