Artificial Intelligence (AI)-enhanced learning analytics (LA) for supporting career decisions: advantages and challenges from user perspective

Egle Gedrimiene[1] · Ismail Celik[1] · Antti Kaasila[1] · Kati Mäkitalo[1] · Hanni Muukkonen[1]

Abstract

Artificial intelligence (AI) and learning analytics (LA) tools are increasingly implemented as decision support for learners and professionals. However, their affordances for guidance purposes have yet to be examined. In this paper, we investigated advantages and challenges of AI-enhanced LA tool for supporting career decisions from the user perspective. Participants ($N=106$) interacted with the AI-enhanced LA tool and responded to open-ended questionnaire questions. Content analysis was utilized for the data analysis applying two distinct and robust frameworks: technology acceptance model (TAM) and career decision-making model (CDM) as well as looking into user needs. Results indicate that the AI-enhanced LA tool provided five main benefits to the users: provision of career information, research and analysis of the information, diversification of ideas on possible career paths, providing direction and decision support, and self-reflection. The participants perceived the AI-enhanced LA tool as a supportive asset to be used in transitional life situations characterized with uncertainty. Considerable use difficulties were reported as well as need for further diversification of ideas on possible career paths, need for personalization and self-reflection support, and need for further information. Results regarding perceived support for making career decisions showed that CDM elements were unequally supported by the AI-enhanced LA tool. Most support was focused to investigate smaller number of provided options and make decisions, while contextual information was lacking. Implications for career decision making are discussed.

Keywords AI-enhanced learning analytics users · Career decisions · Technology acceptance model · Career decision-making model

---

In the 21st century, individuals are increasingly making career transitions (Sullivan & Ariss, 2021), necessitating a growing number of educational and occupational decisions. In fact, making career decisions is regarded as an important life skill and refers to key competencies in the context of lifelong learning (Neary et al., 2015; Sultana, 2012). It has been argued that learning analytics (LA) can potentially support humans in lifelong learning and associated transitions (Poquet et al., 2021). So far, LA tools extensively utilizing data about learners and their environments (Ifenthaler & Yau, 2020; Papamitsiou & Economides, 2014) have been mostly used to support learning and guide students within higher education institutions (Charleer et al., 2018; de Laet et al., 2020; Guerra et al., 2019, 2020; Gutierrez et al., 2020; Iatrellis et al., 2017). With the advances of AI, LA tools can better collect and analyze data and ultimately produce more accurate results (Zawacki-Richter et al., 2019). In other words, users might be provided with personalized and adaptive career guidance based on data gathered about them and their environments (Gati & Asulin-Peretz, 2011; Guleria & Sood, 2022; Kettunen & Sampson, 2019).

However, we highlight two important gaps in the studies regarding LA and AI applications for career guidance. First, the users' perspectives on these technologies are neglected. Second, the role of AI and LA technologies remains unclear in the context of career decisions and transitions. In response to these gaps, we investigate multiple aspects of AI-enhanced LA tool for career guidance from users' perspective. This is done to uncover possible contributions of AI-enhanced LA to career guidance. We aim to better understand how can AI-enhanced LA tool help move through life transitions, what kind of difficulties users experience and what life circumstances prompt the use of such tool. This work contributes to better understanding user perspectives, which are critical in the design and use of LA tools (Buckingham Shum et al., 2019; Knight et al., 2016) as well as career guidance services (Plant & Haug, 2018).

Namely, this article examines benefits and challenges perceived by the users, user described use circumstances and perceived support for making career decisions. We maintain that technology acceptance model (TAM) is a suitable framework for understanding the role of AI-enhanced LA applications in career guidance. This is because the essential constructs of TAM cover perceived usefulness, ease of use and intention to use a particular technology, which matches our study aims. Further, we regard making career decision as a process of individuals considering several education alternatives and choosing one of them at certain points of their lives (Kulcsar et al., 2020). In this regard, technology could support career decisions by facilitating a systematic approach to this process. To understand how AI-enhanced LA tool supported users career decision, we relied on career decision making (CDM) model. Therefore, we drew upon two distinct theoretical frameworks, namely TAM and CDM. The novelty of this study lies in its explanations from the lens of both information-technology-based constructs (i.e., TAM) and career decision making process (i.e., CDM).

1 Theoretical framework

1.1 Technology acceptance model

Proposed and developed by Davis (1989) the TAM addresses users' acceptance and use of a particular technological tool. In the TAM, actual technology use is determined by individuals' behavioral intention to use a technology. Behavioral intention is affected by attitude towards that technology, and by the direct and indirect influences of perceived usefulness and perceived ease of use. Perceived ease of use refers to a user's belief indicating the use of technology will be free of effort (Davis, 1989). Perceived usefulness is defined as the extent to which a user believes that using a technology will increase or improve their job performance and productivity (Davis, 1989). Thus, people tend to use or not to use a particular technology to the extent that they believe it will enhance their job performance. Many studies in the relevant literature provided evidence of the impact of perceived ease of use and perceived usefulness on the attitudes towards use and behavioral intention (King & He, 2006; Legris et al., 2003). Behavioral intentions are defined as motivational factors influencing behavior. Generally, stronger intention predicts greater likelihood of specified behavior (Ajzen, 1991). Research on the acceptance of information and communication technology highlights the importance of behavioral intentions in predicting actual technology use (Ajzen, 2001; Turner et al., 2010; Venkatesh et al., 2003). Several different extensions and modifications have been suggested for the original TAM, by proposing cultural and social influences for behavior intentions, as well as suggesting multiple antecedents for perceived usefulness and ease of use (Hornbæk & Hertzum, 2017; Venkatesh et al., 2003). However, perceived usefulness, ease of use and behaviour intentions remain the core of the model.

1.2 Career guidance and career decision-making model

Increasingly complex education and work environment requires individuals to make multiple career decisions and experience increasing number of career transitions during one's life (Sullivan & Ariss, 2021). These decisions have important and lasting consequences. For instance, educational decisions were reported to affect access to further education (Thompson, 2005), access to job opportunities and employment status (Schmillen, 2019; Iannelli & Smyth, 2017; Thompson, 2005), income (Chevalier, 2011; Sullivan et al., 2018; Kim et al., 2015) and socioeconomic status (Wolniak et al., 2008).

To provide support for career decisions, career guidance draws on two key cornerstones –the content of the decisions and the process of the decisions (Gati & Kulcsar, 2021). While content is usually defined as the skills, competencies, and interests of an individual, the process orientation is concerned with the ways career decisions are made (Gati & Kulcsar, 2021). A better-quality career decision-making process is expected to lead to better-quality decisions and more favorable outcomes for an individual.

Several career decision models were suggested to facilitate the career decision-making process systematically. For instance, the Career Decision Making (CDM)

model (Gati & Tal, 2008; Gati & Asher, 2001); Communication, Analysis, Synthesis, Valuing, and Execution (CASVE) cycle (Osborn et al., 2020), and the dynamic career decision-making model (Esbroeck et al., 2005). These career decision-making models are theoretically grounded, practice-oriented approaches trying to offer an optimal strategy for making career decisions by adapting decision theory to the vocational domain (for a more comprehensive overview of prescriptive models see Gati and Kulcsar (2021). They outline a pragmatic framework for a systematic career decision-making process (Gati & Tal, 2008), which could be used in different career transitions. Their main advantage is the balance between the emphasis on the utility of er choice and human limitations in decision making (Gati & Kulcsar, 2021).

While each of these models propose different steps for the individual to take, the common features are availability and combination of information about self and the world of work (1), investigation of this information (2), and prioritization of several options (3). CDM provides the most detailed description of these essential elements of information provision and processing; therefore, it might be utilized as a framework for career guidance technology development and evaluation. In this model, career alternatives are systematically narrowed down by combining information on individual and career alternatives and it consists of three elements: prescreening, in-depth exploration, and choice (Gati & Asher, 2001). The CDM is visualized in Fig. 1. The figure also visualizes the information needed for the process – information about self and information about careers, which are merged in the prescreening phase.

Prescreening of many alternatives is based on individual preferences, and various aspects of careers can be taken into consideration, such as expected income or required length of training. The aspects can be considered important by the individual in both their positive and negative values (Gati & Tal, 2008). The goal of this stage is to identify a smaller, manageable set of career alternatives. Gathering information about important and favorable aspects of careers and personal preferences is an important part of this phase. In-depth exploration consists of a thorough examination and comparison of the identified alternatives. The goal of this stage is to locate a small number of suitable alternatives based on comprehensive information. Finally, the user makes a choice based on the results of an in-depth examination of alternatives and can include several best-suited options. Individuals are encouraged to use the career decision-making model flexibly and to move back and forth between the stages, depending on their needs (Gati & Tal, 2008).

Fig. 1 The CDM and the information needed to make the decision
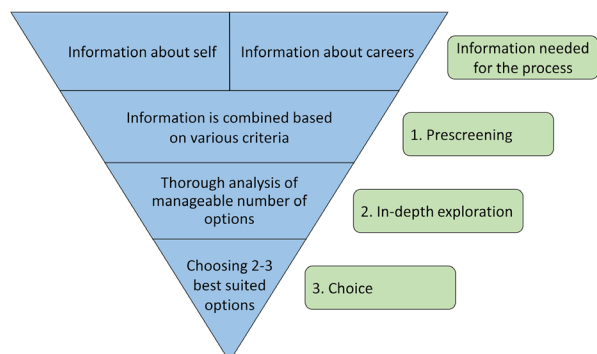
2 The use of Artificial Intelligence (AI) and Learning Analytics (LA) in career guidance

The widespread use of big data technologies allows to collect huge amounts of data from learners and their environments (Gašević et al., 2016). For the last decade, this data has been considered an asset leading to the emergence of the field of LA (Siemens, 2013). Accordingly, LA refers to the measurement, collection, analysis, and reporting of data about learners and their contexts (Siemens, 2013). LA is increasingly interconnected with AI and its subfields (Siemens, 2013), such as machine learning and natural language processing which are among the most prevalent subfields of AI (Celik et al., 2022). In this process, LA can rely on AI methods to better collect and analyze learners' data, and to produce more accurate results (Ez-Zaouia & Lavoué, 2017; Zawacki-Richter et al., 2019). Meanwhile, AI is defined as "computers which perform cognitive tasks, usually associated with human minds, particularly learning and problem-solving" (Baker & Smith, 2019, p. 10). AI is not a single technology, rather it is regarded as a computer field with a variety of sub-fields. The most notable sub-fields are machine learning, natural language processing, and deep learning (Zawacki-Richter et al., 2019). In this regard, LA tools powered by AI might capture data from the learners and their environment and process it ultimately producing personal and environment-specific outputs. More specifically LA tools have the potential to present and visualize collected personal learning data about various aspects of a user's life, such as habits and interests, further enabling individuals to improve self-knowledge through visual support for revisiting and investigating their personal history (Verbert et al., 2013, 2020). Utilizing AI for career guidance purposes has generated high hopes in the field (Brown et al., 2020) and contributed to envisioning far reaching and elaborated guidance systems of students (Khare et al., 2018; Westman et al., 2021;). AI is recognized for its potential to support human decision making, including career decisions, and increase the quality of career guidance services (Gati & Kulcsar, 2021).

Recently, LA tools have made their first steps in supporting academic advising of students (de Laet et al., 2020; Guerra et al., 2020; Gutierrez et al., 2020). Functionalities such as identifying future learning opportunities and creating personalized recommendations are often exploited for academic advising purposes, for instance by helping students choose programs and majors, select and schedule courses, make long term course plans, and to investigate their academic paths (Solis, 2016; Iatrellis et al., 2017; Guerra et al., 2019; Guleria & Sood, 2022). Similarly, career decisions can be supported by technology keeping in mind specific nature and context of the decisions such as the short-and long-term consequences, number of available alternatives, familiarity with the alternatives, and the central position of an individual to make the decision (Gati & Kulcsar, 2021).

3 The aim of the study

First, in this study we seek to explore advantages and challenges of the AI-enhanced LA tool in the context of career transitions and to provide user-centered evidence for further development. This is done through the perspective of the TAM framework which is employed as a lens for the analysis. Secondly, the study aims to investigate the perceived support the AI-enhanced LA tool provides for users' career decision-making process. This is analyzed though the CDM framework, employing CDM as a representation of the decision-making process. More generally, the study contributes to better understanding the use and adoption of AI-based tools for career guidance and for employing emerging technologies to direct human life paths. The study focuses on the user's perspective, which plays a key role in the development of sustainable services in LA (Buckingham Shum et al., 2019; Knight et al., 2016) and career guidance (Plant & Haug, 2018).

4 Contributions of the study

This study offers several contributions. First, it expands the understanding of LA use beyond institutional boundaries by focusing on the perspective of individual concerned with career transitions. Previous research emphasized LA tool use in higher education (Tsai et al., 2020) leaving the perspective of lifelong learning unaccounted. It has also been recognized that little is known about the type of support needed to help individuals in transitional life situation (Poquet et al., 2021). In response to this gap, the current study focusses on the users described support experiences in the context of educational transition.

Secondly, the study attempts to connect guidance technology with the theoretical guidance concepts by focusing on the decision-making process and how this process is supported by the AI-enhanced LA tool. LA tools so far have been explored in connection to learning processes and constructs such as motivation, engagement, and academic performance (Karaoglan Yilmaz & Yilmaz, 2021; Silvola et al., 2021; Kew & Tasir, 2022). Different from previous studies, in this study we address the career decision-making process, which might be regarded as another important contribution.

Thirdly, the study dives deep into user perception analysis by adopting a qualitative approach. Previous research on LA use and acceptance generally measured perceived usefulness, ease of use, and intention to use factors with pre-determined items using scales (Herodotou et al., 2019; Ali et al., 2013). These studies suggested important and valuable empirical results on LA tool acceptance based on the TAM framework (e.g., Ali et al., 2013). However, less is known about what constitutes TAM constructs such as usefulness in the context of guidance. For example, the perceived usefulness of AI-based tools may appear differently in a context of career transitions as compared to planning and monitoring progress of the studies. Thus, here we employed qualitative approaches to explore perceived usefulness, ease of use and intention to use in the context of career transitions.

And lastly, this research provides empirical evidence on the user needs for outlining further AI-enhanced LA tools development in the field of guidance. Indeed, users'

needs, and expectations are the key for developing LA (Silvola et al., 2021), which are also critical in the acceptance of emerging technologies, particularly AI-enhanced career guidance tools.

To achieve our aims, we addressed the three following research questions.

4.1 Research questions (RQs)

RQ1: How did users describe advantages, challenges, and use purposes of the AI-enhanced LA tool for supporting their career decisions based on TAM framework?

RQ2: What are users' needs for further AI-enhanced LA career guidance tool development?

RQ3: How did the AI-enhanced LA tool support the users' career decision-making process based on CDM framework?

5 Materials and methods

5.1 Research design and participants

This research utilized qualitative research design and content analysis of open-ended survey collected from 106 users (Table 1) of the AI-enhanced LA tool. The users tried out the AI-enhanced LA career guidance tool in career guidance sessions in three vocational education and training (VET) institutions in central and northern Finland in 2019. The users were recruited by guidance counselors in these schools since all users needed career guidance and considered starting or changing education in VET or applied science universities. As the demographic information was voluntary for the participants to fill, some of them chose not to provide full demographic details, as reflected in Table 1.

5.2 Instruments

User perceptions about the AI-enhanced LA career guidance tool were gathered using an online open-ended questionnaire. Three open-ended questions were asked to address use intentions and the support from the AI-enhanced LA guidance tool: *(1) In what situations would you use the LA tool? (2) Could the LA tool help you apply for an education or a job? Why yes or why not? (3) How could you benefit from the information you got using the LA tool?* To gather user needs for further development, we asked two additional open-ended questions: *(4) What feedback could you give about the tool? (5) What functionalities would you want the LA tool to have?* Questions 1–3 were used to answer RQs 1 and 3. Questions 4–5 were used to answer RQ 2.

Table 1 Overview of user demographic characteristics

Characteristic		*N*
Education level		
	Basic education	77
	VET /not higher VET /general upper secondary education	18
	Higher education	10
Gender		
	Women	60
	Men	45
Work experience		
	under 6 months	58
	6–12 months	8
	1–5 years	19
	5–10 years	2
	over 10 years	15
Language background		
	Finnish	92
	Other language	12
Age		
	<20 years	66
	21–30 years	16
	31–40 years	9
	>40 years	4
Current situation (overlapping)		
	Employed	12
	Unemployed	2
	In education or training	71
	Applying to education	30

5.3 The AI-enhanced LA career guidance tool

We tested the AI-enhanced LA career guidance tool developed in the Competence Leap project. The AI-enhanced LA career guidance tool utilized national-level Finnish education registry data and recommends relevant program choices from vocational education and training (VET) or applied science universities in Finland. The recommendation is formed based on a natural language processing technique (NLP), subfield of AI and similarity of analyzed contents (development details at: https://github.com/Opetushallitus/compleap). From the user perspective, the LA career guidance tool is deployed in the following process: Evaluating users' previous education (Fig. 2), identifying users 'current interests (Fig. 3), and browsing recommended study programs (Fig. 4).

Information on previously completed education (Fig. 2) is obtained from the Finnish national repository for study records for multiple levels of education entitled KOSKI (Finnish National Agency for Education, n.d., a). The users are presented with their previous education divided into study units. Study units are the parts of VET degrees describing the competence based on the definitions of the Finnish National Agency for Education (Finnish National Agency for Education, n.d., b). Due to educational repositories' limitations imposed by Finnish legislation (Act on

Fig. 2 Previous education section in the AI-enhanced LA career guidance tool

Fig. 3 Interests section in the AI-enhanced LA career guidance tool

the National Registers of Education Records, Qualifications and Degrees 884/2017 4§) it is not possible to use user's personal data for a proof of concept LA career guidance tool. Thus, data on users' personal previous educational data was inaccessible and was substituted by several educational backgrounds. Further, users were asked to

Recommended study places

Showing the most suitable study places from selected area on your studies and selected fields of interests. You can restrict the are further, if you want.

Location: Add limit   ▼

Dancer
Vocational upper secondary qualification in dance industry: Vocational upper secondary qualification in dance industry
5 learning opportunities

Logger
Competence area in forestry: Vocational upper secondary qualification in forestry
19 learning opportunities

Musician
Competence area in music: Vocational upper secondary qualification in competence area of music
18 learning opportunities

Fig. 4 Recommended study programs and study places in the AI-enhanced LA career guidance tool

select the most relevant education background from the list to identify their likes and dislikes with the specific study program (Fig. 2).

The expression of current interests (Fig. 3) complements previous education information and was developed using a Finnish service for the publication and utilization of vocabularies, ontologies, and classification of general education interest areas (https://finto.fi/en/about). Approximately 150 objects were grouped under 13 top-level concepts. For example, sculpture, dance, painting, film, and literature were all grouped under the art and culture concept. This allowed the users to elaborate on their interests by selecting the most motivating topics by choosing from three to ten interests.

Recommended study programs (Fig. 4) tied together the previous two components by automating prescreening and offering education recommendations, which consist of a study program and study place in a concrete location and institution. The user's previous education and interests were compared with educational descriptions of VET and applied science universities' programs to find matching content. Available study programs were then presented based on the data in Studyinfo.fi, an official website containing all the information about study programs leading to a degree in Finland. The users could additionally filter study programs by region and were provided with a list of academic institutions providing recommended study programs.

5.4 Data analysis

To answer the research questions, content analysis (Bengtsson, 2016) was used on the users' responses to five open-ended questions considering both qualitative and quantitative aspects of the data. First, two researchers analyzed the data, creating and refining the sub-categories using inductive approach, where themes arose from the

data (Bengtsson, 2016). The interrater agreement as expressed in agreement percentage (Gisev et al., 2013) for the identified themes was 84.84%, as calculated for 10% of the data. A unique meaningful thought was the unit of analysis, and the coding was not limited in length.

Then, to answer first and second research questions, we analyzed user-perceived advantages, difficulties, use intentions, and further development needs regarding the AI-enhanced LA career guidance tool. To achieve this, the first author grouped subcategories into themes and assigned them to corresponding theoretical constructs. The definitions and operationalizations of the employed TAM and user need constructs are presented in Table 2. A similar approach has been previously utilized by Ifenthaler and Volker (2013), who investigated TAM constructs qualitatively in the study of educational technology.

Next, to answer the third research question, we analyzed the support the AI-enhanced LA guidance tool provided for career decisions-making process. To achieve this, the users' 192 answers previously identified in perceived usefulness category were selected for further analysis and categorized according to the CDM framework by the first author. Definitions and operationalization of CDM constructs are presented in Table 3. The results are presented in Fig. 5 visualizing the quantitative outcomes of the analysis. The intensity of darkness of the blue color refers to the support the AI-enhanced LA tool provided to each CDM element. The darker blue color indicated that CDM element is supported stronger by the AI-enhanced LA tool, i.e., as expressed by frequency of the users' answers.

6 Results

6.1 Advantages, challenges and use purposes of the AI-enhanced LA tool

The first research question investigated how users describe advantages, challenges, and use purposes of the AI-enhanced LA tool for career guidance based on TAM framework. Results clustered according to the TAM framework concepts are presented in Table 4.

Users described the AI-enhanced LA tool for guidance as beneficial for five main purposes: information provision, research and analysis, diversification of ideas on career paths, providing direction and decision support, and self-reflection. Category of information provisions contains a variety of answers related to education, jobs, and career information. The category of research analysis contains answers relating to various activities done with provided information, such as searching, mapping and comparison of information, as well as being able to think about provided programs and education choices in general. Category of diversification of ideas on career paths holds answers related to diversity of provided information and career recommendations. Users described getting variety of alternative education suggestions and some claimed getting new ideas they have not though about before. Category of providing direction and decision support reflects user expectations related AI-enhanced LA tool being useful for applying to education programs as well as becoming more confident, getting assurance to make the decisions and take further steps. Finally, the category

Table 2 Operationalization of the TAM constructs and user needs in relation to the AI-enhanced LA guidance tool

Construct	Definition	Operationalization regarding the AI-enhanced LA guidance tool	Sample answer
Perceived usefulness	"The degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989, p. 320).	Users described advantages of using the tool for guidance.	"In the end I got more information in general about many professions." (woman, age 16, studying)
Ease of use	"The degree to which a user believes that the use of a technological innovation will be free of effort" (Davis, 1989, p. 320).	Users described difficulty or simplicity of using the tool for guidance.	"Could be clearer." (woman, age 16, studying)
Intention to use	"Intention of a user to use a technological innovation for job related purposes" (Ifenthaler & Volker, 2013, p. 527).	Users described life circumstances when one could use the tool for guidance.	"On a general level, you want to use the applications like this at an intersection where you are considering a career choice." (man, age 51, applying to education)
User needs	"User needs refer to [...] the difference between users' goals and the present condition, which is manifested by user problems and possibilities [...]" (Kujala et al., 2001, p. 45).	Users described problems with the tool for guidance as well as suggestions for its further development.	"There are not enough [interest] options in the menu. You could write, for example, in another section yourself." (man, age 16, applying to education)

Table 3 Operationalization of the CDM constructs in relation to the AI-enhanced LA guidance tool

Construct	Definition	Operationalization regarding the AI-enhanced LA guidance tool
Information about self	Information about self that is useful in making career decisions. E.g., interests, competencies, aptitudes, and limitations. (Gati & Tal, 2008)	Users expressed their thoughts on the tool for guidance providing information for self-reflection and understanding of oneself.
Information about career opportunities	Information about career opportunities that is useful in making career decisions. E.g., key features of educational programs and occupations, availability of jobs and educational programs. (Gati & Tal, 2008)	Users expressed their thoughts on the tool for guidance providing information about work and education.
In depth exploration	Process of extensively familiarizing with relevant smaller set of options before deciding. (Gati & Tal, 2008)	Users expressed thoughts indicating an action of research and analysis and diversification of ideas on educational options.
Choice	Prioritizing and selecting 2–3 most suited options for a satisfying decision. (Gati & Tal, 2008)	User expressed thought indicating an action of selecting an educational study program, occupation or using the tool to apply to education

of self-reflection contained answers related to the AI-enhanced LA tool being useful to learn about own interest and skills.

Further, the challenges of using the AI-enhanced LA tool were related to usability difficulties and are described in the ease-of-use category. The category contained users' visual and cognitive challenges of using the tool. For instance, users expressed various complaints and suggestions regarding the need to improve the tool's graphical design and information presentation as well as the need for instructions and support during use.

Finally, users intended to use the AI-enhanced LA tool in various life situations characterized by uncertainty e.g., unemployment, dropping out of studies, choosing new field of study, or searching for further education possibilities.

6.2 Users' needs for further AI-enhanced LA career guidance tool development

The second research question focused on the users' needs for further development of the LA career guidance tool. Results for this investigation are presented in Table 5.

The users expressed number of suggestions for further development which were categories into three main themes: diversification of ideas on career paths, personalization and self-reflection, and more information. Strong emphasis was placed on the need for diversification and personalization by asking for more diverse educational options and making the recommendations more personalized and tailored to the individual personality, interests, and life situations.

6.3 The support for career decision from AI-enhanced LA tool

The third research question focused on the support AI-enhanced LA tool provided to the users' decision-making process. The results indicate that not all steps of the decision-making process were supported equally. Figure 5 visualizes the quantitative results of content analysis with intense blue color indicating more accounts of support reported by the users.

In-depth exploration element of career decision making process was the best supported, as many users answers ($f=91$) concentrated on various exploration activities enabled by the AI-enhanced LA guidance tool. Choice element, although less, was also supported by indications of users getting encouragements and confidence to make decisions and to apply to study programs ($f=54$). Contrarily, information about careers ($f=33$) and information about self ($f=16$), ware the least supported elements. Especially small number of accounts were found regarding the AI-enhanced LA tool providing users with information useful for self-reflection. Prescreening phase was completed by the AI-enhanced LA tool and did not require any user effort nor awareness; therefore, it is not included in the Fig. 5.

Table 4 AI-enhanced LA tool's advantages, challenges and use purposes based on TAM from user perspective

| Theoretical TAM constructs	Grouped sub-categories (f)	Sub-categories (f)	Answer examples
Perceived usefulness	Education and work information provision (31)	• Getting information about study places and programs (19) • Information about professions (7) • Unspecified information provision (5)	"The application provides a lot of information about training places and training opportunities." (woman, age 16, studying) "At the end, you also get a lot of information about many professions in general." (woman, age 16, studying) "You get more information about the field." (woman, age 17, applying to education)
	Research and analysis (63)	• Searching and mapping (39) • Thinking about study possibilities (17) • Comparing (7)	"I could find several suggestions on the app and research them more." (man, age 18, studying) "Makes you think about different fields." (man, no age information, studying) "[I would use it] to compare the contents of different professional fields." (man, age 17, applying to education)
	Diversification of ideas about career paths (28)	• Getting variety of study alternatives (22) • Getting new ideas (6)	"It showed many options and there were suggestions of other professional options than business administration, which had the same features." (woman, age 17, studying) "The application presented different options based on my interest, so I discovered fields I didn't even know about." (man, age 19, studying)
	Providing direction and decision support (54)	• Finding or applying to suitable study programs (25) • Getting assurance and confidence to decide (18) • Choosing or applying for an occupation/job (6) • Consider applying to suggested study program (5)	"The application could help me to apply for a study place that is just right for me." (man, age 18, studying) "The app helps you choose own path and find your direction." (woman, age 25, working) "To support and guide professional orientation." (woman, age 36, working) "I could imagine applying to study in the fields suggested by the application." (man, age 20, applying to education)
	Self-reflection (16)	• Getting information related to own interests (12) • Learning about yourself (4)	"I can associate certain interests with certain fields of interest, such as "Art and Culture." (man, age 19, studying) "Application helps to identify own capabilities and strengths." (woman, no age information, studying)
Ease of use	Difficult to use (39)	• Instruction on how to use the tool needed (27) • Improvement of visual and structural elements needed (12)	"The instructions need to be clearer, not always understanding what to do next." (man, age 27, studying) "The app's bright yellow color is distracting and makes it difficult to read and concentrate on use." (woman, age 18, studying)
	Easy to use (19)	• Effort-free use (19)	Very simple and easy to use, which is just what is needed for this purpose." (woman, age 36, studying)

Table 4 (continued)

Theoretical TAM constructs	Grouped sub-categories (f)	Sub-categories (f)	Answer examples
Intention to use	Transitional life situations characterized by uncertainty (86)	• When it is not clear what to study (26)	"Especially in situations where you know you are interested in certain things and certain types of activities or tasks, but do not know where to utilize it or in what area they are needed." (man, age 26, applying to education)
		• In situations when you want to study further (24)	"[You would use it] when you have time to think about your future plans and alternatives for continues education." (woman, age 23, working)
		• To choose new field of study or change your current one (14)	"For example, if you know that you don't want to continue in this field, so you can look for suitable field." (woman, age 17, studying)
		• Deciding on future studies while still in basic education (9)	"When I was 16, it would help me know what I was doing." (man, age 22, studying and applying to education)
		• For career related purposes (9)	"[I would use this] in connection with changing my profession." (woman, no age information, studying)
		• After dropping out of studies (2)	"[You would use this] especially if you have dropped out of your studies." (man, age 27, working)
		• When unemployed (2)	"[I would use this] when being unemployed." (man, age 24, unemployed)

Table 5 Users described needs for further AI-enhanced LA tool development

Theoretical construct	Grouped sub-categories (f)	Sub-categories (f)	Answer examples
User needs	Diversification of ideas about career paths (26)	• More diverse educational alternatives are needed (26)	"[There was a] limited range of educational options – doesn't feel life I have benefited." (woman, no age information, studying)
	Personalization and self-reflection (27)	• More personalization needed (16) • More accurate recommendations needed (4) • Stronger connection between interest and recommendations needed (4) • More detailed information on interest needed (3)	"The application cannot take into account a person's individuality/personality." (woman, age 50, working and applying to education) "[Education recommendations are] too different and too many. A more accurate result would serve better." (woman, age 37, working) "[Education recommendations] didn't match my interests in any way. I left my [previous] education unfinished and choose completely different things as an object of interest [...]. Still, I get study suggestions related to it, but not suggestions related to my interests." (woman, age 37, studying) "I chose many [interests], although some were more interesting than others." (woman, age 19, applying to education)
	Information provision (9)	• More information on further steps to apply to education needed (6) • More career related information needed (3)	"It would be good if there were additional information on which papers/certificates are needed for the application." (man, age 20, studying) "You could add a "Jobs" section to the application, where you could see vacancies in certain fields. The user could also see where there is employment [possibilities] in relation to interest." (man, age 18, studying)
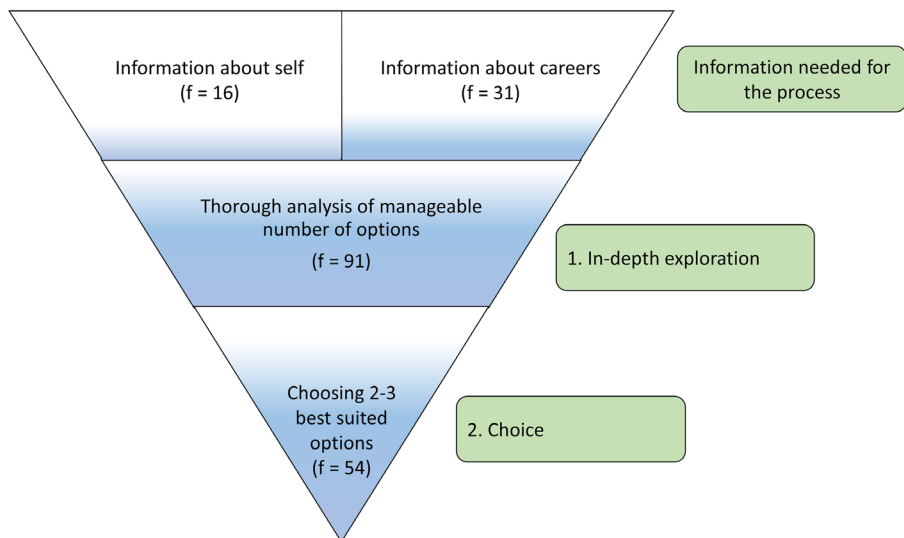
Fig. 5 Support for users' decision-making process provided by the AI-enhanced LA tool

7 Discussion

The current study described users' perceptions about the AI-enhanced LA tool for career guidance. The dimensions of user perception were determined based on the TAM framework, which is suitable for investigating the acceptance and usage of emerging technologies (Oyman et al., 2022). Scherer and Teo (2019) also highlighted that most educational technology acceptance studies have failed to focus on specific technology. Without providing concrete experience to users, it might be challenging to reveal their reasons for acceptance or rejection of technology and to provide sound insights into practice (Islamoglu et al., 2021; Tao et al., 2022). In response to this gap, we aimed to explore users' thoughts after they engaged with AI-enhanced LA tool.

As per our first research question, five main advantages of the AI-enhanced LA tool for guidance were identified, namely: *provision of career information*; *research and analysis of provided information*; *diversification of ideas on possible career options; providing direction and decision support;* and *self-reflection.* These findings provide new knowledge in the context of technology supported guidance. Previous research identified information provision, communication support and automation of interactions as important roles for guidance technology (Hooley et al., 2015). This study expands on existing understanding by describing broader scope of ways technology can contribute and support individuals. The results help to determine types of support AI and LA tools might provide for individuals in a context of lifelong learning and associated transitions, which has been previously identified gap in research (Poquet et al., 2021). User described types of support are discussed further.

First, quality information on educational opportunities, careers, and job market situation were essential for the users of the AI-enhanced LA guidance tool. This finding stays consistent with previous research which identified information provision as a key role of technology for guidance (Hooley, 2015). In addition to this, our study

shows that users emphasize not only being passive receivers of the information but actively engaging with the provided information by exploring it further. This finding provides support for career guidance approaches emphasizing active learning during the process of career guidance (Krumboltz, 2009). Accordingly, AI and LA tool should create possibility to actively examine the provided information with user inquiries. Diversification of career paths by providing different educational possibilities emerged as another key advantage from the users' perspective. In line with career guidance literature, diversification of career paths is a key element in effective career guidance (Musset & Kurekova, 2018) and an objective for social justice (Skohvus, 2016). Our study adds to this knowledge by showing that diversification of ideas about career possibilities is an important user expectation. Thus, LA career guidance tools could respond to this by helping users to re-evaluate their interests in different contexts. Further, the users recognized the AI-enhanced LA tool as beneficial for providing direction and decision support. Individuals might be rather confused and indecisive when they are about to make an important decision on their academic or work life (Selder, 1989; Schlossberg, 2007). At such moments, supporting assets that strengthen and encourage individual are important (Schlossberg, 2007). Our results indicate that users perceive AI-enhanced LA guidance tool to be such a supportive asset during life transitions and described getting assurance and confidence from the tool to make necessary decisions. And lastly, users' self-reflection was identified as another possible benefit from the AI-enhanced LA guidance tool. For instance, users claimed that the AI-enhanced LA tool has helped them identify their interest and to understand them better in work life context. Support for self-reflection has been also previously determined as a key goal of LA in education (Greller & Drachsler, 2012).

Further, users described some challenges about using the AI-enhanced LA tool, which were evaluated in the light of ease-of-use concept from the TAM framework. Several use difficulties were identified such as graphical and structural imperfections that made use complicated. Users also expressed the need for support e.g., instructions and human guidance. Prior research has recognized that users need to get familiar with the interface when they interact with an emerging technology (Dutta et al., 2022). A considerable number of usability related answers indicates a possible gap in digital career literacy, which is a previously recognized concern (Hooley et al., 2015). Thus, clarity and simplicity of use must be emphasized in the development of digital guidance tools.

Next, users named several life situations where they intend to use the AI-enhanced LA tool. The use intentions focused on two main areas - education and work, which reflects the domains of career concept (European Lifelong Guidance Policy Network, 2014). The common features of the identified life circumstances were uncertainty and the need to make decisions among multiple options, which corresponds to the previously recognized characteristics of transitional life situations (Selder, 1989; Schlossberg, 2007). This finding further indicates that the AI-enhanced LA guidance tool was perceived as a supportive asset in career transitions and goes to shows vulnerable position of prospective users.

Our second research question focused on the user needs in connection to further AI-enhanced LA tool development. Three main needs were identified: *the need for further diversification of ideas on career paths, the need for better personalization and self-reflection, and the need for further information*. The identified needs directly correspond to previously identified benefits of using the AI-enhanced LA tool for guid-

ance, highlighting the importance of these themes to the users. For instance, although diversity of recommendations was already well evaluated in the current version of the AI-enhanced LA tool, a variety of education alternatives was also stressed for further development, suggesting that diversity of recommendations is a key concept to address in guidance tools development. Supporting results were obtained by Gati et al. (2003) where variety and length of the recommended list of occupations positively correlated with users' satisfaction (Gati et al., 2003). Integration of diverse education and work life data sources could be a way to address users' need for diversity and provide information about study programs at various levels of education locally and abroad. Similarly, information about personal skills, competencies and interests were insufficient for some users. Current AI-enhanced LA tool limitation in this domain can be explained by limited access to the users' data and further efforts should be taken to facilitate self-reflection if AI and LA tools strive to provide successful career decision making support. Users expressed this need by referring to more personalization, such as questions about personality and interests. Such information could lead to more accurate career recommendations and provide opportunities for improved self-reflection for the user. These findings correspond to previous research where tailored support was seen as a key opportunity to improve career guidance service (Donald et al., 2018).

Our third research question concerned the support AI-enhanced LA guidance tool provided for the users' career decision-making process. The results showed that investigated process elements were supported unequally. On one hand the AI-enhanced LA tool helped the users to investigate a manageable number of educational options, provided direction and assurance needed to make decisions. On the other hand, important contextual information such as information about self and the world of work was lacking. Previous research has identified lack of self-knowledge as a significant struggle in making career decisions (Gati et al., 1996); therefore, self-reflection of users should be better supported by tool's emphasis on future goals, professionally relevant skills, and interests. Another important implication of this funding is that the support of the AI-enhanced LA tool might lead to changes in the recommended decision-making process from the user perspective. The information analysis process and the information used in the process by the AI-enhanced LA guidance tool are hidden from the view of the users and the users are presented with the final list of recommendations. This might interfere with the purpose of users understanding and learning how to make career decisions – one of the key goals of using career decision-making models in career guidance (Kulcsar et al., 2020). Previous research has shown that user trust in provided career recommendations is high (Gedrimiene et al., 2023) and emphasized the importance of users being able to critically evaluate career guidance from AI tools (Gati & Kulcsar, 2021). Therefore, we suggest putting stronger emphasis on the user self-reflection and enablement of different user inquiries in the development of the AI-enhanced LA guidance tools.

7.1 Limitations and further research

This research focused on qualitatively investigating user perceived benefits, challenges, use intentions and support for decision-making process from the AI-enhanced LA tool for career guidance. Further research could for example investigate to what

extent AI tools diversify user ideas about possible career paths and how could they be used successfully utilized for various contexts. It is also important to acknowledge that digital tools are not used, and career choices are not made in isolation but in a greater socioeconomical context of individual's life. Although this article takes an instrumental approach to technology and an optimistic view to career decisions, limitations and support for career choices stem also from other sources such as social environment, individual aptitudes, finance, and health. Moreover, various forms of exclusion and biases can lead to formation of certain career paths for individuals in society and also make their way into the digital guidance world (Staunton, 2019; Elias et al., 2017). These topics are, however, beyond the scope of this article. Similarly, constrains of current personal data legislation in Finland resulted in utilization of limited number of user profiles in the AI-enhanced LA guidance tool and could have affected the user responses. A rather small sample and varying demographic characteristics limit generalization of our findings.

8 Conclusions

This study is the first attempt to provide in-depth results of users' perceptions of the AI-enhanced LA tool for career guidance. We conclude that the users intended to use the investigated AI-enhanced LA tool as a supportive asset for career transitions characterized by uncertainty. The tool showed promise to facilitate these transitions by offering five main advantages as described by users. Specifically: providing career information, facilitating research and analysis of this information, diversifying ideas on career paths, self-reflection, and providing direction and decision support. These findings suggest possible directions of the AI-based technology development to provide value for users in the context of lifelong learning and associated transitions. And lastly, the use of the AI-enhanced LA tool for guidance led to deviation from theoretical career decision-making process which might counteract with original purpose of users learning to make career decisions.

Gedrimiene, E., Kaasila, A., Muukkonen, H. (2020): Competence Leap project: End user experiences. Gedrimiene, E., University of Oulu. Questionnaire. https://urn.fi/urn:nbn:fi:att:37b33301-ac3e-4bc3-886c-8e66f70d77d9.

Declarations

Conflict of interest No conflict of interest to declare.

Informed consent The users provided informed consent to participate in the study. The university does not require a statement from an ethics committee for non-invasive studies. No conflict of interest.

References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Ajzen, I. (2001). Nature and Operation of attitudes. *Annual Review of Psychology*, *52*, 27–58. https://doi.org/10.1146/annurev.psych.52.1.27

Ali, L., Asadi, M., Gašević, D., Jovanović, J., & Hatala, M. (2013). Factors influencing beliefs for adoption of a learning analytics tool: An empirical study. *Computers & Education*, *62*, 130–148.

Baker, T., & Smith, L. (2019). Educ-AI-tion rebooted? Exploring the future of artificial intelligence in schools and colleges. Retrieved from Nesta Foundation website: https://media.nesta.org.uk/documents/Future_of_AI_and_education_v5_WEB.pdf

Bengtsson, M. (2016). How to plan and perform a qualitative study using content analysis. *NursingPlus Open*, *2*, 8–14. https://doi.org/10.1016/j.npls.2016.01.001

Brown, A., Kettunen, J., & Vuorinen, R. (2020). *Lifelong guidance policy and practice in the EU: Trends, challenges, and opportunities. Final report*. European Commission, Directorate-General for Employment, Social Affairs and Inclusion, Publications Office. https://doi.org/10.2767/91185

Buckingham Shum, S., Ferguson, R., & Martinez-Maldonado, R. (2019). Human-centred learning analytics. *Journal of Learning Analytics*, *6*(2), 1–9. https://doi.org/10.18608/jla.2019.62.1

Celik, I., Dindar, M., Muukkonen, H., & Järvelä, S. (2022). The promises and challenges of artificial intelligence for teachers: A systematic review of research. *Technology Trends*, *66*, 616–630. https://doi.org/10.1007/s11528-022-00715-y

Charleer, S., Moere, A. V., Klerkx, J., Verbert, K., & De Laet, T. (2018). Learning analytics dashboards to support adviser-student dialogue. *IEEE Transactions on Learning Technologies, 11*(3), 389– 399. https://doi.org/10.1109/TLT.2017.2720670

Chevalier, A. (2011). Subject choice and earnings of UK graduates. *Economics of Education Review*, *30*(6), 1187–1201. https://doi.org/10.1016/j.econedurev.2011.04.007

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, *13*(3), 319–339. https://doi.org/10.2307/249008

De Laet, T., Millecamp, M., Ortiz-Rojas, M., Jimenez, A., Maya, R., & Verbert, K. (2020). Adoption and impact of a learning analytics dashboard supporting the advisor-student dialogue in a higher education institute in Latin America. *British Journal of Educational Technology*, *51*(4), 1002–1018. https://doi.org/10.1111/bjet.12962

Donald, W. E., Ashleigh, M. J., & Baruch, Y. (2018). Students' perceptions of education and employability: Facilitating career transition from higher education into the labor market. *Career Development International*, *23*(5), 513–540. https://doi.org/10.1108/CDI-09-2017-0171

Dutta, R., Mantri, A., & Singh, G. (2022). Evaluating system usability of mobile augmented reality application for teaching Karnaugh-maps. *Smart Learning Environments*, *9*, Artcile 6. https://doi.org/10.1186/s40561-022-00189-8

Elias, T., Honda, P. L., Kimmel, M., & Chun, J. W. (2017). A mixed methods examination of 21st century hiring processes, social networking sites, and implicit bias. *The Journal of Social Media in Society*, *5*(1), 189–228. https://thejsms.org/index.php/JSMS/article/view/151

Esbroeck, R. V., Tibos, K., & Zaman, M. (2005). A dynamic model of career choice development. *International Journal for Educational and Vocational Guidance*, *5*, 5–18. https://doi.org/10.1007/s10775-005-2122-7

European Lifelong Guidance Policy Network (2014). *Lifelong Guidance Policy Development: Glossary* (ELGPN Tools No. 2). http://www.elgpn.eu/glossary

Ez-Zaouia, M., & Lavoué, E. (2017). EMODA: A tutor oriented multimodal and contextual emotional dashboard. *Proceedings of the 7th International Conference on Learning Analytics & Knowledge (LAK'17)*, 13–17 March 2017, Vancuver British Columboa, Canada (pp. 429–438). ACM Press. https://doi.org/10.1145/3027385.3027434

Finnish National Agency for Education (n.d., a). KOSKI - a National Registry and Data Transfer Service for Study Rights and Completed Studies. https://www.oph.fi/sites/default/files/documents/Mikkonen_koski_en_25012021.pdf

Finnish National Agency for Education (n.d., b). Tutkintojen perusteet [Study units]. https://www.oph.fi/fi/koulutus-ja-tutkinnot/tutkintojen-perusteet

Gašević, D., Dawson, S., & Pardo, A. (2016). How do we start? State and Directions of Learning Analytics Adoption. *2016 ICDE Presidents' Summit, December* 1–24. https://doi.org/10.13140/RG.2.2.10743.42401

Gati, I., & Asher, I. (2001). Pre-screening, in-depth exploration, and choice: From decision theory to career counselling practice. *The Career Development Quarterly*, *50*(2), 140–157. https://doi.org/10.1002/j.2161-0045.2001.tb00979.x

Gati, I., & Asulin-Peretz, L. (2011). Internet-based self-help career assessments and interventions: Challenges and implications for evidence-based career counseling. *Journal of Career Assessment, 19*(3), 259–273. https://doi.org/10.1177/1069072710395533

Gati, I., Kleiman, K., Saka, N., & Zakai, A. (2003). Perceived benefits of using an internet-based interactive career planning system. *Journal of Vocational Behavior*, *62*(2), 272–286. https://doi.org/10.1016/S0001-8791(02)00049-0

Gati, I., Krausz, M., & Osipow, S. H. (1996). A taxonomy of difficulties in career decision making. *Journal of Counselling Psychology*, *43*(4), 510–526. https://doi.org/10.1037/0022-0167.43.4.510

Gati, I., & Kulcsar, V. (2021). Making better career decisions: From challenges to opportunities. *Journal of Vocational Behavior*, *126*, 103545. https://doi.org/10.1016/j.jvb.2021.103545

Gati, I., & Tal, S. (2008). Decision-making models and career guidance. In J. A. Athanasou, & R. V. Esbroeck (Eds.), *International handbook of career guidance* (pp. 157–185). Springer.

Gedrimiene, E., Celik, I., Mäkitalo, K., & Muukkonen, H. (2023). Transparency and trustworthiness in user intentions to follow career recommendations from a learning analytics tool. *Journal of Learning Analytics, 10*(1), 54–70. https://doi.org/10.18608/jla.2023.7791

Gisev, N., Bell, J. S., & Chen, T. F. (2013). Interrater agreement and interrater reliability: Key concepts, approaches, and applications. *Research in Social and Administrative Pharmacy*, *9*(3), 330–338. https://doi.org/10.1016/j.sapharm.2012.04.004

Greller, W., & Drachsler, H. (2012). Translating learning into numbers: A generic framework for learning analytics. *Educational Technology & Society*, *15*(42), 42–57. https://www.jstor.org/stable/jeductechsoci.15.3.42

Guerra, J., Ortiz-Rojas, M., Zúñiga-Prieto, M. A., Scheihing, E., Jiménez, A., Broos, T., De Laet, T., & Verbert, K. (2020). Adaptation and evaluation of a learning analytics dashboard to improve academic support at three Latin American universities. *British Journal of Educational Technology*, *51*(4), 973–1001. https://doi.org/10.1111/bjet.12950

Guerra, J., Scheihing, E., Henríquez, V., Olivares-Rodríguez, C., & Chevreux, H. (2019). TrAC: Visualizing students' academic trajectories. In M. Scheffel, J. Broisin, V. Pammer-Schindler, A. Ioannou, & J. Schneider (Eds.), *Lecture Notes in Computer Science, vol. 11722. Transforming Learning with Meaningful Technologies* (pp. 765–768). Springer. https://doi.org/10.1007/978-3-030-29736-7_84

Guleria, P., & Sood, M. (2023). Explainable AI and machine learning: performance evaluation and explainability of classifiers on educational data mining inspired career counseling. *Education and Information Technologies, 28,* 1081–1116. https://doi.org/10.1007/s10639-022-11221-2

Gutierrez, F., Seipp, K., Ochoa, X., Chiluiza, K., De Laet, T., & Verbert, K. (2020). LADA: A learning analytics dashboard for academic advising. *Computers in Human Behavior*, *107*, Article 105826. https://doi.org/10.1016/j.chb.2018.12.004

Herodotou, C., Rienties, B., Boroowa, A., Zdrahal, Z., & Hlosta, M. (2019). A large-scale implementation of predictive learning analytics in higher education: The teachers' role and perspective. *Educational Technology Research and Development*, *67*(5), 1273–1306. https://doi.org/10.1007/s11423-019-09685-0

Hooley, T. (2014). *The evidence base on lifelong guidance*. European Lifelong Guidance Policy Network. Jyväskylä. https://derby.openrepository.com/handle/10545/333589

Hooley, T., Shepherd, C., & Dodd, V. (2015). *Get yourself connected: Conceptualizing the role of digital technologies in Norwegian career guidance*. International Centre for Guidance Studies, University of Derby. http://hdl.handle.net/10545/579570

Hornbæk, K., & Hertzum, M. (2017). Technology acceptance and user experience: A review of the experiential component in HCI. *ACM Transactions on Computer-Human Interaction*, *24*(5). https://doi.org/10.1145/3127358

Iannelli, C., & Smyth, E. (2017). Curriculum choices and school-to-work transitions among upper secondary school leavers in Scotland and Ireland. *Journal of Education and Work*, *30*(7), 731–740. https://doi.org/10.1080/13639080.2017.1383093

Iatrellis, O., Kameas, A., & Fitsilis, P. (2017). Academic advising systems: A systematic literature review of empirical evidence. *Education Sciences*, *7*(4). https://doi.org/10.3390/educsci7040090

Ifenthaler, D., & Volker, V. (2013). The acceptance of Tablet-PCs in classroom instruction: The teachers' perspectives. *Computers in Human Behavior*, *29*(3), 525–534. https://doi.org/10.1016/j.chb.2012.11.004

Ifenthaler, D., & Yau, Y. K. J. (2020). Utilising learning analytics to support study success in higher education: A systematic review. *Education Technology Research and Development*, *68*, 1961–1990. https://doi.org/10.1007/s11423-020-09788-z

Islamoglu, H., Yurdakul, K., I., & Ursavas, O. F. (2021). Pre-service teachers' acceptance of mobile-technology-supported learning activities. *Educational Technology Research and Development*, *69*(2), 1025–1054. https://doi.org/10.1007/s11423-021-09973-8

Karaoglan Yilmaz, F. G., & Yilmaz, R. (2021). Learning analytics as a metacognitive tool to influence learner transactional distance and motivation in online learning environments. *Innovations in Education and Teaching International*, *58*(5), 575–585. https://doi.org/10.1080/14703297.2020.1794928

Kettunen, J., & Sampson, J. P. (2019). Challenges in implementing ICT in career services: Perspectives from career development experts. *International Journal for Educational and Vocational Guidance*, *19*(1), 1–18. https://doi.org/10.1007/s10775-018-9365-6

Kew, S. N., & Tasir, Z. (2022). Developing a learning analytics intervention in e-learning to enhance students' learning performance: A case study. *Education and Information Technologies*, *27*(5), 7099–7134. https://doi.org/10.1007/s10639-022-10904-0

Khare, R., Stewart, B., & Khare, A. (2018). Artificial intelligence and the student experience: An institutional perspective. *IAFOR Journal of Education*, *6*(3). https://doi.org/10.22492/ije.6.3.04

Kim, C. H., Tamborini, C. R., & Sakamoto, A. (2015). Fields of study in college and lifetime earnings in the United States. *Sociology of Education*, *88*(4), 320–339. https://doi.org/10.1177/0038040715602132

King, R. W., & He, J. (2006). A meta-analysis of the technology acceptance model. *Information & Management*, *43*(6), 740–755. https://doi.org/10.1016/j.im.2006.05.003

Knight, D. B., Brozina, C., & Novoselich, B. (2016). An investigation of first-year engineering student and instructor perspectives of learning analytics approaches. *Journal of Learning Analytics*, *3*(3), 215–238. https://doi.org/10.18608/jla.2016.33.11

Krumboltz, J. D. (2009). The happenstance learning theory. *Journal of Career Assessment, 17*(2), 135–154. https://doi.org/10.1177/1069072708328861

Kujala, S., Kauppinen, M., & Rekola, S. (2001). Bridging the gap between user needs and user requirements. In N. Avouris, & N. Fakotakis (Eds.), *Panhellic Conference with International Participation in Human-Computer Interaction (PC-HCI2001)* (pp. 45–50). Software Usability Network, University of Patras.

Kulcsar, V., Dobrean, A., & Gati, I. (2020). Challenges and difficulties in career decision making: Their causes, and their effects on the process and the decision. *Journal of Vocational Behavior, 116*, Artcile 103346. https://doi.org/10.1016/j.jvb.2019.103346

Laki valtakunnallisista opinto- ja tutkintorekistereistä [Act on the National Registers of Education Records, Qualifications and Degrees], 884/2017 4§. https://www.finlex.fi/fi/laki/alkup/2017/20170884

Legris, P., Ingham, J., & Collerette, P. (2003). Why do people use information technology? A critical review of the technology acceptance model. *Information & Management*, *40*(3), 191–204. https://doi.org/10.1016/S0378-7206(01)00143-4

Musset, P., & Kurekova, L. M. (2018). *Working it out: Career guidance and employer engagement* (OECD Education Working Papers, No. 175). OECD Publishing. https://doi.org/10.1787/51c9d18d-en

Neary, S., Dodd, V., & Hooley, T. (2015). *Understanding career management skills: Findings from the first phase of the CMS LEADER project*. International Centre for Guidance Studies, University of Derby. http://hdl.handle.net/10545/595866

Osborn, D. S., Sides, R. D., & Brown, C. A. (2020). Comparing career development outcomes among undergraduate students in cognitive information processing theory-based versus human relations courses. *The Career Development Quarterly*, *68*(1), 32–47. https://doi.org/10.1002/cdq.12211

Oyman, M., Bal, D., & Ozer, S. (2022). Extending the technology acceptance model to explain how perceived augmented reality affects consumers' perceptions. *Computers in Human Behavior*, *128*, Article 107127. https://doi.org/10.1016/j.chb.2021.107127

Papamitsiou, Z., & Economides, A. A. (2014). Learning analytics and educational data mining in practice: A systematic literature review of empirical evidence. *Educational Technology & Society*, *17*(4), 49–64. https://www.jstor.org/stable/jeductechsoci.17.4.49

Plant, P., & Haug, E. H. (2018). Unheard: The voice of users in the development of quality in career guidance services. *International Journal of Lifelong Education*, *37*(3), 372–383. https://doi.org/10.1080/02601370.2018.1485058

Poquet, O., Kitto, K., Jovanovic, J., Dawson, S., Siemens, G., & Markauskaite, L. (2021). Transitions through lifelong learning: Implications for learning analytics. *Computers and Education: Artificial Intelligence*. https://doi.org/10.1016/j.caeai.2021.100039

Scherer, R., & Teo, T. (2019). Editorial to the special section—technology acceptance models: What we know and what we (still) do not know. *British Journal of Educational Technology*, *50*(5), 2387–2393. https://doi.org/10.1111/bjet.12866

Schlossberg, K. N. (2007). *Overwhelmed: Coping with Life's Ups and Downs* (2nd ed.). M. Evans & Company.

Schmillen, A. (2019). Vocational education, occupational choice, and unemployment over the professional career. *Empirical Economy*, *57*, 805–838. https://doi.org/10.1007/s00181-018-1484-x

Selder, E. F. (1989). Life transition: The resolution of uncertainty. *Nursing & Health Care: Official Publication of the National League for Nursing*, *10*(8), 437–440. 449 – 51. PMID: 2797502.

Siemens, G. (2013). Learning analytics: The emergence of a discipline. *American Behavioral Scientist*, *57*(10), 1380–1400. https://doi.org/10.1177/0002764213498851

Silvola, A., Näykki, P., Kaveri, A., & Muukkonen, H. (2021). Expectations for supporting student engagement with learning analytics: An academic path perspective. *Computers & Education*, *168*. https://doi.org/10.1016/j.compedu.2021.104192

Skohvus, R. B. (2016). A focus on educational choice has social justice consequences - an empirical study informed by Sen's capability approach. *Journal of the National Institute for Career Education and Counselling*, *36*(1), 54–60. https://doi.org/10.20856/jnicec.3607

Solis, O. A. P. (2016). *Design and evaluation of the impact of a multi-agent control system (framework) applied to a social setting* [Doctoral dissertation, The University of Texas]. ProQuest Dissertations & Theses. https://www.proquest.com/dissertations-theses/design-evaluation-impact-multi-agent-control/docview/1803590344/se-2?accountid=13031

Staunton, T. (2019). Icarus, grannies, Black Holes and the death of privacy: Exploring the use of digital networks for career enactment. *British Journal of Guidance & Counselling*, *48*(5), 611–622. https://doi.org/10.1080/03069885.2019.1698007

Sullivan, A., Parsons, S., Green, F., Wiggins, R. D., & Ploubidis, G. (2018). Elite universities, fields of study and top salaries: Which degree will make you rich? *British Educational Research Journal*, *44*(4), 663–680. https://doi.org/10.1002/berj.3453

Sullivan, E. S., & Al Ariss, A. (2021). Making sense of different perspectives on career transitions: A review and agenda for future research. *Human Resource Management Review, 31*(1). https://doi.org/10.1016/j.hrmr.2019.100727

Sultana, R. G. (2012). Learning career management skills in Europe: A critical review. *Journal of Education and Work*, *25*(2), 225–248. https://doi.org/10.1080/13639080.2010.547846

Tao, D., Fu, P., Wang, Y., Zhang, T., & Qu, X. (2022). Key characteristics in designing massive open online courses (MOOCs) for user acceptance: An application of the extended technology acceptance model. *Interactive Learning Environments*, *30*(5), 882–895. https://doi.org/10.1080/10494820.2019.1695214

Thompson, S. (2005). *Pathways from school to further education or work: Examining the consequences of year 12 course choices* (Longitudinal Surveys of Australian Youth, No. 42). The Australian Council for Educational Research. https://research.acer.edu.au/lsay_research/46

Tsai, Y. S., Rates, D., Moreno-Marcos, P. M., Muñoz-Merino, P. J., Jivet, I., Scheffel, M., & Gašević, D. (2020). Learning analytics in European higher education—trends and barriers. *Computers & Education*, *155*. https://doi.org/10.1016/j.compedu.2020.103933

Turner, M., Kitchenham, B., Brereton, P., Charters, S., & Budgen, D. (2010). Does the technology acceptance model predict actual use? A systematic literature review. *Information and Software Technology*, *52*(5), 463–479. https://doi.org/10.1016/j.infsof.2009.11.005

Venkatesh, V., Morris, G. M., Davis, B., G., & Davis, D. F. (2003). User Acceptance of Information Technology: Toward a unified view. *MIS Quarterly*, *27*(3), 425–478. https://www.jstor.org/stable/30036540

Verbert, K., Duval, E., Klerkx, J., Govaerts, J. S., & Santos, J. L. (2013). Learning analytics dashboard applications. *American Behavioral Scientist*, *57*(10), 1500–1509. https://doi.org/10.1177/0002764213479363

Verbert, K., Ochoa, X., De Croon, R., Dourado, A., R., & De Laet, T. (2020). Learning analytics dashboards: The past, the present and the future. *Proceedings of the Tenth International Conference on Learning Analytics & Knowledge (LAK '20)*, (pp. 35–40). Association for Computing Machinery. https://doi.org/10.1145/3375462.3375504

Westman, S., Kauttonen, J., Klemetti, A., Korhonen, N., Manninen, M., Mononen, A., Niittymäki, S., & Paananen, H. (2021). Artificial Intelligence for career guidance – current requirements and prospects for the future. *IAFOR Journal of Education: Technology in Education*, *9*(4), 43–62. https://doi.org/10.22492/ije.9.4.03

Wolniak, G. C., Seifert, T. A., Reed, E. J., & Pascarella, E. T. (2008). College majors and social mobility. *Research in Social Stratification and Mobility*, *26*(2), 123–139. https://doi.org/10.1016/j.rssm.2008.02.002

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education–where are the educators? *International Journal of Educational Technology in Higher Education*, *16*(1), 1–27. https://doi.org/10.1186/s41239-019-0171-0

Authors and Affiliations

Egle Gedrimiene[1] · Ismail Celik[1] · Antti Kaasila[1] · Kati Mäkitalo[1] · Hanni Muukkonen[1]

✉ Egle Gedrimiene
egle.gedrimiene@oulu.fi; e.gedrimiene@gmail.com

Ismail Celik
ismail.celik@oulu.fi

Antti Kaasila
antti.kaasila@oulu.fi

Kati Mäkitalo
kati.makitalo@oulu.fi

Hanni Muukkonen
hanni.muukkonen@oulu.fi

[1] Faculty of Education and Psychology, University of Oulu, FIN-90014 OuluP.O. Box 8000, Finland