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INCLUSive Disaster Education

INCLUDE

Online research repository with open educational resources

Intellectual Output 5 Report

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1. Introduction

O5 has number of objectives:

1. Encourage research among underrepresented communities (in the EU and also elsewhere) by providing access to world class DRR research through an open access repository.
2. Medium to share, showcase DRR research and educational material easily, and increase stakeholder visibility.
3. Enable and promote lifelong learning within the DRR community by strengthening research capacity.
4. A platform to share unpublished work such as datasets, dissertations, reports, case studies, multimedia content in DRR etc.
5. Maintain long-term preservation and accessibility to DRR related research outputs.

The repository functions as an essential digital archival facility for the DRR community, ensuring continuous access to past research and past training material such as; datasets, thesis, webinars, material from workshops etc.

The repository also functions as a knowledge creation and a dissemination tool for EU and like-minded international researchers from the DRR community. The system will be updated frequently with new research publications, case studies, new scientific advancements and emerging technologies related to DRR etc. This will especially be beneficial to researchers from underrepresented countries or communities, because access to world leading research will improve their own research skills and practices. EU researchers will benefit from improved access to DRR research problems and datasets that were previously hard to access, whereby they can broaden their research experience further and develop research infrastructures within their own institutions as well as for EU funded research programmes.

2. Online learning platforms (Udemy Business, Skillshare, LinkedIn Learning, Coursera, edX, iSpring Market, Kajabi, Podia, iSpring Learn, SAP Litmos, LearnUpon, Blackboard Learn, Canvas, Moodle) overview

In order to reduce disaster risks, technology and innovation links between universities and industry are of critical importance more than ever before to carry out robust research and development activities. Adopting new digital communication tools will be a key driver of change for strengthening collaborations across greater distances, as remote working has now become the new ‘normal’.

Since the technology revolution of the late 1990s, online learning has been gaining popularity as a method for training and instruction. It offers unparalleled convenience, flexibility, and affordability in a world that’s becoming increasingly expensive and busy (Mansaray, 2022). Massive Open Online Courses (MOOCs) offer accessible and affordable remote learning opportunities to students all over the world. Many famous higher education institutions, including Harvard University and the Massachusetts Institute of Technology, deliver these online courses on a variety of topics and at a variety of educational levels. You can take a single class to delve deeply into a particular topic or take a sequence of courses to gain comprehensive knowledge of an area of study (Ngo, 2022). Ngo (2022) have provided these MOOCs online platforms:

1. Canvas Network. Canvas Network specializes in professional development classes for teachers, school administrators, and other education leaders. Topics include leading and applying assessment in student affairs, supporting women in STEM fields, and research data management for librarians. Students can access MOOCs in English, Chinese, Portugese, and Spanish. Like other platforms, Canvas Network provides predominantly free and self-paced online classes. Educators benefit from open licensing options that allow them to freely share and reuse content as well as integrate third-party tools for their own purposes. This perk enables teachers to design and run their own MOOC to bolster traditional classroom instruction.
2. Cognitive Class. Formerly known as Big Data University, Cognitive Class is an initiative by IBM to spread data literacy through free classes for students and experienced IT professionals alike. Users can pursue coursework at their own pace with no time restrictions for completion. These MOOCs cover individual topics like Python for data science, reactive architecture, and digital analytics and regression. Alternatively, learners can enroll in more general learning paths, taking a series of classes on broad subjects like deep learning and Scala programming. Cognitive Class goes beyond pre-recorded lectures, enabling students to practice what they learn through a virtual lab environment. In lieu of a certificate, candidates can earn verified digital badges, which reflect shareable and industry-wide forms of recognition.
3. Coursera. Coursera was founded in 2012 by two Stanford professors and is one of the largest massive open access course providers in the world. The platform partners with 190 companies and universities to provide fully remote and self-paced learning opportunities leading to digital certificates at the undergraduate, graduate, and postgraduate levels. Coursera boasts a high satisfaction rate, with 87% of users reporting career benefits. The catalog contains over 3,900 courses and specializations that span areas like business, computer science, physical science and engineering, arts and humanities, and language learning. Coursera also offers affordable online degrees through its partner schools. Students can earn a master of science in accountancy from the University of Illinois or a global master of public health from Imperial College London.
4. edX. Created as a joint venture between Harvard and MIT, edX is another leading MOOC platform. Students can access more than 2,500 courses from 140 higher education institutions covering popular subjects like data science and the humanities. The platform also offers computer science classes in Python, front-end and full-stack development, and cybersecurity. edX uses an open-source learning system that allows technologists and educators to augment their MOOCs freely, adding tools that support the specific needs of their students. In addition to professional certificates, learners can earn college credits through the MicroBachelors and MicroMasters programs. edX also delivers full online graduate degrees, including master's credentials for supply chain management, nutritional sciences, and marketing.
5. FutureLearn. FutureLearn is a massive open online course provider founded in the United Kingdom in 2012 by 12 university partners, including King's College London and the University of Leeds. Students can complete one of 418 short courses to learn new skills in areas like digital product management, ecology and wildlife science, and the future of globalization. They may also obtain microcredentials from leading universities and major companies. Additionally, FutureLearn provides low-cost online academic programs that enable candidates to earn a bachelor of arts in international business or a master of science in cybersecurity. Unlike other platforms, FutureLearn structures its courses through narrative, with weekly to-do lists

that help students stay on top of coursework. Learners can also access one-on-one support from a network of tutors.

6. iversity. Based in Berlin, iversity partners with a variety of companies, nongovernmental organizations, and universities across Europe to deliver more than 60 courses in English, German, and French. The platform maintains industry standards with the help of web designers and UX developers, ensuring the highest levels of usability and student engagement. The organization also offers corporate training services through its "iversity for Business" initiative. Students can access traditional MOOCs or fast-paced "Espresso" classes in areas like data-driven marketing, international labor standards, and climate change and health. Iversity also offers intensive "Pro" courses that require candidates to pay a tuition price. Students can save money by bundling "Pro" classes.
7. Kadenze. Kadenze was launched in 2015 as a for-profit company with the support of 18 institutional partners, including Princeton University and the Rhode Island School of Design. This MOOC provider focuses on music, visual arts, creative technology, and other fields of study that lagged behind due to the prominence of STEM education. Students enjoy self-paced, mobile-friendly content that lets them showcase their skills with professional portfolio tools. Users can access individual classes that cover topics in cinematic storytelling, project management for designers, and sound production in Ableton. Although Kadenze offers most of its MOOCs for free, students can pay to access in-depth feedback and other premium content. Kadenze also offers curated programs that enable learners to specialize in a subject.
8. Khan Academy. Khan Academy bases its organizational mission on the belief that education is a human right. To this end, the platform offers entirely free online courses that integrate instructional videos, practice exercises, and a personalized learning dashboard. Unlike many other MOOC providers, Khan Academy largely supports K-12 students, with content for pre-algebra, English language education, AP chemistry, and U.S government and civics. Learners may also access preparation materials for standardized tests, including the SAT, ACT, GRE, NCLEX-RN, and even the Praxis exams. Furthermore, Khan Academy offers resources for teachers and parents, who can assign standards-aligned course materials and track student progress. Through networking tools, users may connect with students and teachers across the globe.
9. Udacity. Udacity is a for-profit MOOC platform that focuses on career development through technical and vocational online courses. Topics span six areas of study, which include data science, cloud computing, autonomous systems, and artificial intelligence. Students can also take programming and development classes in C++, Blockchain, and Android developer. Additionally, working professionals may complete MOOCs that help them gain product management and marketing analytics skills. Beyond diverse course offerings, Udacity delivers comprehensive career services, including personalized job coaching, resume writing guidance, and LinkedIn best practices. The Udacity Talent Program lets users create detailed profiles and connect with major employers like Google and Mercedes-Benz.
10. Udemy. As the largest online learning provider, Udemy offers over 150,000 courses in 65 languages. While students can take a variety of free courses, many MOOCs require a fee. By paying for premium content, users also gain access to features like direct messaging, Q&A, and certificates of completion. Topics cover 11 broad categories, including office productivity,

health and fitness, and photography. Students can also complete finance and accounting classes, learning the key elements of Bitcoin and blockchain or developing global market analysis skills. Additionally, Udemy provides personal development content that enables users to manage stress, improve their self-esteem, and cultivate meaningful relationships. The sheer variety of MOOCs allow you to use these courses to supplement a college education or gain entirely new skills and knowledge. MOOCs also benefit working professionals who want to learn specialized and technical competencies to advance their careers. Lastly, these online classes are a great tool to network with other learners and industry experts worldwide.

Mansaray (2022) has also compiled a list of the most popular MOOC platforms with pros and cons. The author's analysis is presented in the Table 1.

Table 1. Online Learning Platforms advantages and disadvantages by Mansaray (2022)

Online Learning Platform	**Advantages**	**Disadvantages**	**Pricing**
Udemy Business	Easy to use Quality control measures Completion certificates Integrates with LMSs	No course creation functions Only supports video-based courses Passive learning (i.e., lack of interactivity) Certificates not recognized by employers	Udemy Business offers two pricing plans: Team (5-20 users): $360 per user/year Enterprise (21+ users): Contact sales for a custom quote.
Skillshare	Engaged social community of learners Large pool of courses Engagement and analytics reports Multiple marketing integrations	Only supports video-based courses No LMS integration Doesn’t offer certificates Quality control is challenging, since anyone can be an instructor	Skillshare has a 3-tiered pricing plan: Starter (2-19 users): $159 per user/year Enterprise (20+ users): Contact sales for a custom quote. Revive (51+ users): Contact sales for a custom quote.
LinkedIn Learning	Instructors are vetted for quality control measures Appeals to different learning styles (e.g., rather than videos, there’s an option for scrolling transcripts) Increased interactivity with hands-on practice exercises and quizzes Completion certificates that can be shared on your LinkedIn profile	Cannot interact with teachers or fellow learners Limited course topics (e.g., only business, tech, and visually creative) No LMS, marketing, or analytics integrations Completion certificates aren’t accredited	LinkedIn Learning offers a monthly and annual plan as an all-access pass for individuals. Annual: $26.99/month Monthly: $39.99/month
Coursera	Well-structured, high-quality courses from reputed institutions	Limited range of course topics (mainly business and science)	Coursera offers a 3-tier pricing plan:

	Transcripts accompany videos to cater to different learning styles Completion certificates that are recognized by many employers/institutions Financial aid for low-income learners and/or learners from developing nations Follows a classic academic style of learning	Some courses have start and end dates, meaning you might miss out Large body of learners means instructors often don't respond to your questions or provide feedback For assignments requiring peer reviews, particularly in the less popular courses, this could take a long time, which means you'll have to wait longer for your certificate of completion while continuously paying for your monthly subscription	Single learning program (for a single course): $49-$79/month Coursera Plus Annual (access to all courses): $59/month Coursera Plus Monthly (access to all courses): $399/year
edX	Offers accredited, highly recognized completion certificates Offers courses from prestigious organizations like Harvard and MIT Most courses can be completed at your own pace Wide variety of course topics and learning programs to choose from Partially free online learning platform that lets you audit courses Low-income learners can apply for financial aid	Because partners can create courses as they see fit, there's a lack of uniformity in course structuring Relatively lower course count (3,000+) compared to other platforms Somewhat clunky interface	edX: While edX offers free courses, the "Verified Track" route (paid) can range from $50 to $300, depending on the course(s) you enroll in. If you're pursuing a master's degree, which has more courses, this number can jump as high as $10,000–$25,000. edX for Business: For groups (small teams/businesses): $349 per learner/year; Enterprise (large organizations): Contact sales for a custom quote.
iSpring Market	Maximum flexibility with course content types Hosts courses with sophisticated interactions Gamified learning environment with points, badges, and leaderboards Incentivizes sales with limited time offers and coupons Issues completion certificates Ultimate flexibility with payment methods and currencies	Basic marketing options Basic admin options Completion certificates are unaccredited	iSpring Market offers 4 pricing plans: 500 users (25 GB): $77/month 1,000 users (50 GB): $147/month 2,000 users (100 GB): $277/month Custom: Contact sales for a custom quote.

	Detailed analytics for tracking learner engagement and progress		
Kajabi	Well-designed user interface and user experience One-stop-shop solution from course development to sales Highly customizable from a branding and marketing perspective Great video streaming abilities Beautiful, professionally designed landing pages	Lacks interactivity and student engagement features Doesn't issue completion certificates Steep learning curve, especially during initial setup stages Pricier than most other online learning platforms	Kajabi has a 3-tier pricing model: Basic: $149/month Growth: $199/month Pro: $399/month
Podia	Instant payouts Zero transaction fees Easy to use, minimalist interface Membership site integrated within your digital storefront Unlimited everything (bandwidth, courses, etc.) Integrated email marketing, including affiliated marketing Student progress tracking	Limited customization options Lacks key learning tools (graded assessments, completion certificates, etc.) Basic reporting and analytics abilities Inflexible course builder Relatively low number of templates for storefront pages	Podia has 3 pricing plans: Mover: $39/month Shaker: $89/month Earthquaker: $199/month
iSpring Learn	Comes with a free sophisticated authoring tool (iSpring Suite) as well as a built-in authoring tool for simpler courses Well-designed, intuitive user interface for even the most technologically illiterate Integrates with Zoom and MS Teams effortlessly for blended learning courses Mobile app that works on both Android and iOS 24/7 live support	No eCommerce features No custom reports No support for courses published in xAPI or cmi5 formats	iSpring Learn comes with 4 pricing plans (billed annually): 100 users: $3.66 per user/month 300 users: $3.00 per user/month 500 users: $2.82 per user/month Custom: Contact sales for a custom quote.
SAP Litmos	Affordable pricing packages Comprehensive suite of learning tools Applicable across all industries Supports many course formats, including SCORM Includes a library of useful training courses across many industries	Slight learning curve if you're new to LMSs After assigning a course to a team, individual users cannot be removed No tagging option, which slows down the assessment and feedback process	Contact sales for a custom quote.
LearnUpon	Tailored training via learning portals Completion certificates	Administrative flexibility is relatively low Doesn't work directly with HTML5 courses	LearnUpon's pricing plan has 3 levels:

	Can create branded digital storefronts Offers multiple integrations (Salesforce, Zapier, HubSpot, etc.) Supports versatile content types, including xAPI and SCORM	Expensive	Essential (150 active users, 2 portals): $1,249/month Premium (500 active users, 3 portals): $1,999/month Enterprise (500+ active users, 3+ portals): Contact sales for a custom quote.
Blackboard Learn	Provides smooth and efficient bidirectional communication between educators and students Easy to navigate both the learner's side and teacher's side Numerous plug-ins to fill in any functionality holes Includes the Blackboard SafeAssign plagiarism detector	Can't market or sell your courses Needs a user experience and design makeover Mobile app still functions but is a bit 'buggy' Long setup time; but once it's up and running, it's easy to maintain	Starts at $9,500 per year. Contact sales for a custom quote.
Canvas	Everything you need is under one roof Vast selection of integrations Social learning and collaboration tools SpeedGrader feature for reducing time spent grading assignments/submissions	Intense learning curve required to unlock its full potential Little to no gamification features	Canvas is both a paid and free online learning platform. Paid: Contact sales for a custom quote. Free: The free account unlocks many features, including creating courses, quizzes, and video conferences, creating tailored learning via Mastery Paths, access to the Canvas mobile app suite, and integration with third-party apps.
Moodle	Extremely customizable; there are hundreds of parameters and settings to choose from Comes with a highly functional mobile app Built-in assessment tools with a quiz bank that can randomize questions Integrates with H5P, which enables highly interactive content	Reports and analytics are limited Requires a steep learning curve for newbies Interface is chaotic and can be confusing for beginners Doesn't offer learning paths	Moodle's a free online learning platform. However, hosting your Moodle site will cost money, as will certain third-party integrations.

There are a number of good options for educators looking to build their own MOOCs. Swope (2014) presented the five most interesting platforms: edX, Moodle, CourseSites, Udemy, Versal. The comparison is given in Fig. 1.

	Max. Class Size	Brandable	Custom Analytics	Monetization	Mobile	Hosting
edX	300,000	✓	✓	✓	✓	Self-Hosted
moodle	10,000	✓	✓	✓	✓	Self-Hosted or 3rd party
COURSEsites by Blackboard	Unlimited	✗	✓	✗	✓	Hosted
udemy academy of you	Unlimited	✗	✗	✓	✓	Hosted
versal	Unlimited	✗	✗	✗	✓	Hosted

Fig. 1. MOOCS platforms comparison (Swope, 2014).

Fig. 2. Map of MOOC providers (BitDegree, 2022).

According to BitDegree (2022), when looking for continuous education online, people tend to face a particular challenge to choose a proper ratio of pricing and quality of the content online learning platforms provide. Some tend to keep their prices very high, which can be a massive issue for people with lower incomes. Quality is critical, as well. Naturally, as reviewers of the best online course platforms, BitDegree (2022) pay a lot of attention to these factors. The map has been designed to help to choose the best MOOC provider according to their pricing and content quality (Fig. 2).

3. Literature review

3.1. Role of 5G and artificial intelligence and online learning platforms grounded on AI

With the online learning platforms grounded on AI techniques, 5G has revolutionized the teaching and learning methods by smooth and faster access to educational content (Yu & Nazir, 2021).

Lee and Kim (2020) have proposed a study for the impact of 5G in university education based on specific parameters like learning space, content and time, etc. The experiments were performed on 102 students, and they ranked every parameter according to their opinion and use. About 86% of them were in favor of using 5G in education. The students want to study by the use of intelligent devices and valuable materials. They do not wish to be bound by the constraints like time and place. Therefore, it is required to speed up the use of 5G in university education to improve it and make it available at a low cost. Al-Maroof et al. (2021) have proposed a study on various factors directly related to the use of 5G in the Gulf area. The findings show that with cheapness, faster speed, and high quality, Internet usage can be increased by 5G. It can be used in education for the purposes like e-learning and content sharing by teachers and students faster and efficiently. The acceptance rate of 5G is very high due to faster speed and rapid data broadcast. Its easiness of use and effectiveness can bring very positive change in the daily life human race.

Gao (2021) has proposed a study in the era of 5G to find out the applications of modern technology in English major in one of the universities of China. Due to the faster transfer rate and numerous valuable online resources, it is very beneficial in teaching English to help students find appropriate content easily and without any constraints. Most universities provide online courses, and the students can select from them according to their requirements. The usage of 5G in the development of education will be a milestone in human history.

Samigulina and Shayakhmetova (2016) have proposed a study to develop an intelligent system based on deep learning for visually impaired people to get benefits from distance education. The system can process data from diverse dimensions, understanding the perception and consciousness knowledge evidence of visually impaired persons. The vital module of the intelligent system consists of statistics, intelligence, knowledge, and controller block. The materials are provided based on a questionnaire analyzed with the help of fuzzy logic. With the proposed model, the VIP can exploit the educational assets in a very effective way.

Vijayakumar et al. (2019) have proposed a study to make a chatbot for the college to lessen the burden from human staff. With the help of the proposed system, there will be no need to deliver data to different sections but will store in a database in a single place. The system will work based on keywords entered by the user and will provide them with the information as matched with the given words. The students can access any kind of information at any time with the usage of the proposed chatbot. With the planned system, the overall working of college departments and students is improved and organized. The system is built-in Python along with natural language processing, and MySQL is used as data storage. Wang (2021) has presented an overview of applications and advancements of artificial intelligence in daily life and the novelty and development brought by AI-based systems in teaching the English language. The implementation of AI in the English classroom has made the teaching and learning process more optimized and interactive. Students are now able to learn English with high intelligence and a personalized atmosphere. With the advancement in computer-assisted systems and the Internet, the AI-based system is now replacing human teachers in the classroom. The teachers are required to assimilate the new and advanced technologies into the teaching process and curriculum. With the combination of these, the English learning process can be made more productive and mature. Dasic et al. (2016) have proposed a study to dig out the applications and improvement and the usability of ITS in the learning methods of a new era. The online learning model is the combination of recent advancements in information technology and education. ITS usage in e-learning is accepted as very interactive and practical and is very helpful in making individualized learning possible. They are based on artificial intelligence and machine learning; hence, they can make effective strategies for personalized learning and thus keep the self-esteem of a learner. They are helpful to the students in correcting and providing suggestions related to their knowledge. With the implementation of AI algorithms, intelligent tutoring systems can solve any difficulty in teaching and learning. Alhabbash et al. (2016) have proposed an intelligent tutoring system for the learners of English grammar. The students will be able to learn English language grammar in a straightforward and relaxed environment. The proposed approach can generate exercises related to each topic to check the students' skills in a particular section of grammar. It is based on a personalized learning atmosphere and can be used by every student independently. An experiment was performed with a group of students to check the performance of the intelligent tutoring system. The experiment's findings show that the students are in favor of the proposed approach, and their grammar has been improved and developed with the system.

Michaud et al. (2000) have presented a sample of a device to improve and advance the writing skills of deaf students in school and college who are more comfortable with ASL than English. The system can take input from the students in written form and then examine that text for the syntax errors and allow the students to create possible solutions to correct the mistakes. The students are provided with constant feedback by the system and a comfortable, peaceful environment. The system is used for the learning purposes of the user and can analyze both the ASL and English language of the users. Baker et al. (2021) have proposed a study to find out the reliability and practicability of intelligent tutoring systems to develop and increase the vocabulary and expertise of the English language of the students. About 217 students admitted to the English taught program were examined with the intelligent tutoring system. The analysis revealed that students using ITS have improved and developed vocabulary compared to other students. In the opinion of the students, it is exciting and creative to learn with ITS. The teachers are also in favor of the proposed system and accept the system as very effective and fruitful for the learners. The results show that the intelligent system can be used in the classroom to increase the productivity of the teaching and learning process. Terzopoulos and Satratzemi (2019) have proposed a study to analyze the abilities and developments in education by artificial intelligence and natural language processing-based intelligent devices. With the use of AI and NLP, these devices can communicate and interact with the user in human-understandable languages. For providing and assisting disabled people, these voice assistants are proved to be very effective and game-changers. They can lessen the burden from the teacher and perform some functional tasks like assessment, quizzes, and interaction with the students in place of a teacher. However, one of the main disadvantages and matter of concern is that these devices cannot speak many languages. There is a need for proper and organized practice for teachers to use these voice assistants in the classroom. Junaidi et al. (2020) have proposed a study to determine the productivity and impacts of AI-based applications in learning English as a foreign language. For this study, Lyra Virtual Assistant (LVA) is selected due to its simplicity in usage, being cheap, and improving students' pronunciation. An experiment was performed with two groups of students of the seventh class. The analysis shows that the students using the LVA have demonstrated significant improvement and development compared to the other learners. Using the proposed system, the students can achieve high-quality speaking skills and the system is very effective in improving the conversation power of students. The teachers should encourage the students the usage of computer-assisted devices in learning foreign languages. Parab (2020) has proposed a study to show the effectiveness and improvement in the learning process of human teachers compared to AI-based intelligent systems. It was found that lack of human communication is a vital problem in computer-assisted teachers. AI and NLP-based machines should not replace human teachers but should be used for the help of a human to lessen the workload from a teacher. By making the other routine works of teachers automatic, they will be able to focus and concentrate on the skills and knowledge of the students.

The use of AI-based systems and the Internet has carried out revolutions in the field of education for both teachers and students. With the online learning platforms grounded on AI techniques, 5G has modernized the teaching and learning approaches by charming and quicker access to educational content (Yu & Nazir, 2021).

3.2. Internet of Thing (IoT) and IoT platforms

Education and learning are no longer confined to the confines of schools and classrooms. Technology's advancement has altered the way educational institutions operate. The Internet of Things (IoT) has the ability to connect a wide range of objects to the Internet. In a wireless context, artificial intelligence (AI) and machine learning (ML) have the ability to make computers think like and mimic people. These technologies have an impact on every aspect of people's life. They have a wide range of applications in education, manufacturing, healthcare, transportation, smart cities, and energy (Embarak, 2022). The applications of IoT in the educational domain range from IoT enabled classroom boards, IoT enabled attendance monitoring systems, IoT enabled mobile learning, IoT enabled virtual worlds, Smart schools and smart buildings, Smart personalized learning systems, Smart e-learning systems, Smart IoT enabled assessment systems, Smart IoT enabled analytical systems for educational ecosystems, Smart children tracking systems for the parents, Smart school and university security systems, Smart IoT enabled teaching systems etc. (Wangoo & Reddy, 2020).

The education/learning area is not immune to technological advancement. The Internet of Things has played a significant role in engaging learners in the classroom. The Internet of Things has assisted instructors in making their classrooms more dynamic and interesting. IoT makes education more accessible in terms of ability, geography, and socioeconomic condition. Immersion, for example, is a strategy used to learn a foreign language based on real-time input. Learning a language in its home country is simply because the speaker's feedback is openly available. It is difficult to construct similar environments outside of the country, but IoT aids in creating simulation environments in which students can be watched and teachers can provide real-time feedback to pupils. IoT networking can facilitate task-based learning. Students learn-by-doing in doing task-based learning, which allows teachers to support and monitor a student's performance automatically. IoT has been a big help to impaired pupils by giving technical assistance. Along with IoT, AI and ML have made significant contributions to advancements in research and education. AI and ML aid in the automation of time-consuming class operations such as attendance and grading. Educational Software can be customized to meet the demands of the student. IoT and AI aid with e-learning courses by allowing students to access lessons and videos from any location and at any time. Discussion groups and forums also allow students to discuss questions, ideas, and information (Embarak, 2022).

The role of education in propagating knowledge has grown in importance over the last several years due to the fulminatory proliferation of knowledge. Meanwhile, the educational process's paradigm is transforming, requiring different pupils to complete their learning in a variety of ways. As a result, a smart educational environment is promoted. It integrates a variety of information and communication technologies to energize the learning process and adapt to the unique needs of individual pupils. The quality of students' learning processes can be improved by continuously monitoring and evaluating their states and actions via information sensing devices and information processing platforms in order to provide feedback on their learning processes. The Internet of Things is committed to achieving significant variation in life, individual well-being, and organizational productivity. The IoT has the potential to enable expansions and enhancements to critical utilities in a variety of industries by creating a unique environment for application development. Applying the Internet of Things concept to any educational environment would improve the quality of education by allowing students to learn more quickly and teachers to do their duties more efficiently. It is delicate to attempt to influence and modify user behaviour, since it may face resistance and other psychological issues connected to comfort and trust. Emerging technologies such as XAI will aid in the user's comprehension and trust of any system that makes use of AI models. XAI's goal is to employ methods and approaches to communicate to the user what an AI model does and why resulting in a complete understanding of system operations. As a result, tracking, analyzing, and influencing user behavior will become significantly simpler (Gunning & Magazine, 2019; Embarak, 2022).

Ubiquitous learning is a seamless learning whenever it is in information space or in physics space, through ubiquitous computing information space and physics space are converged. In ubiquitous learning environment (ULE) Learning, learning demands and learning resources are everywhere; study, life and work are connected each other. When learners meet any practice problem ubiquitous computing help them to resolve it at anytime, anywhere. In the future, school, library, classroom, meeting room, museum, and the circulation fields send their information and knowledge to the learner through all kinds of technology, every learner immerse into information ecology surroundings that the real world and digital world intermingle. The learners can easily perception and obtaining learning objects detailed information and content through situational perception of mobile devices. Using dialogue, living community, cooperation studies, social process of internalization, participate in joint activity to realize social learning. An effective ubiquitous learning depends on founding of learning environment (Matsuo et al., 2018).

According to learning environment classification, ubiquitous learning environment belong to a kind of learning environment that are deeper, and the highest flexibility. While the basic elements of constructing the learning environment mainly include three parts: ubiquitous communication network, learning terminal device, learning resources. The traditional single point centralized resource storage mode is unable to meet with the ubiquitous learning requirements whether the resource storage or the promptness of obtaining resources. IoT make not only real world are connected, but also the real world (physical narrow room) and virtual worlds (digital information space) are all interconnected, and it support effectively M2M interaction. IoT make every things of learning environment digital, intelligence and networking, make learning seamless integration, learner study what they need at any time, at anyplace, and adjust corresponding learning content, and make learning environment intelligence. For example, monitor and control light brightness by sensor; learn outdoor things by RFID, and so on (Matsuo et al., 2018).

Modern education and e-Learning systems cannot disregard the role of IoT. Vijayalakshmi, Jayasimman (2018) introduced the IoT model that connects actual physical things while researching how technology affects e-Learning. They found that the adoption of IoT-enabled machine learning techniques can improve the e-Learning system.

Virtual reality-based FaceVR paradigm has been proposed (Thies et al., 2018). It generates a realistic image using the image-based method. They recorded the wearer of the head-mounted display's in-progress facial expressions and eye movements. They contrasted it with the captured video that wasn't equipped with a head-mounted display. They immediately re-rendered the realistic image. IoT devices must be secured and protected. Daud et al. (2017) investigated several security threats and vulnerabilities and suggested potential fixes from multiple angles. Additionally, they provided a generalized model of security practices and guidelines that led to the IoT architecture. Bansal and Khan (2018) research also focuses on the emotional intelligence of a user to become more user-like, fidelity prototyping.

The authors Khan et al. (2022) used the regression model machine learning technique to validate and analyze for healing the disease and its prevention at an early stage. They also proposed a comprehensive strategy to forecast the statistical data for government agencies.

Kumar and Al-Besher (2022) suggested framework will determine each student's unique learning style using IoT devices and machine learning methods. The assessments will be given based on that, and the evaluation of the students will be done as such. E-learning platform with a sensor layer integrated to collect physical, environmental, and behavioral data using an IoT-based framework. The platform can be enhanced to provide features for context awareness using this data. Teachers can incorporate cognitive modules to conduct smart solutions that align with the user's needs. The IoT-entity perspective, which exhibits the elements of the architecture's design and associated connections, should be shown first. The service view in this phrase has to be explained.

Moreover, Vharkute, and Wagh (2015) have designed a standard distance learning structure that combines different e-learning applications with the help of the IoT. Student satisfaction increases due to this technology-based approach, which improves the relationship between the student and the teacher while providing a cost-effective education. This training system uses GSM and GPS technology to deliver a suitable and optimal training model. Students will benefit from adopting this strategy in school buses with computer learning facilities since it will help them succeed. Lack of attention to quality is a significant weakness of this method.

Furthermore and Cornel (2015) has presented an IoT-based methodology for establishing online virtual labs, a fundamental prerequisite for any education system to be high-quality and competitive in the global marketplace. This model demonstrates that practical lessons may be conducted using a remote system. Students can now take advantage of IoT capabilities to access the resources they need for various real-world investigations. As a result of this method’s lower costs and higher performance of new electronic modules, it allows for the development of several web services that include data processing and communication via the Internet. By connecting an Arduino platform to the Xively web service, this technique demonstrates how to use the IoT in a practical setting. Unfortunately, this technique has low privacy.

In addition, Abbasy and Quesada (2017) have suggested the most significant and expected effects of the IoT on higher education, including theoretical analysis and a statistical investigation. It examines the most important and most relevant academic and statistical outcomes of IoT in the e-learning paradigm, particularly in the context of learning and management variables. Things such as over communication, teamwork, and research opportunities distinguish this work from the rest of the field. Unfortunately, one of the shortcomings of this strategy is that it does not emphasize IoT applications in the sphere of education.

Zahedi and Dehghan (2019) have discussed IoT-based e-learning in various aspects in which the main advantages of IoT in e-learning and the importance and necessity of using IoT in this regard are stated. Existing challenges and current solutions are discussed and analyzed. The results indicate that IoT will soon be a fundamental process in new technologies in e-learning, and by creating the proper infrastructure and implementing it optimally, universities will benefit significantly from IoT-based online learning models. Of course, the appropriate frameworks for universities wishing to adopt IoT must also be comprehensively and adequately analyzed. Implementation techniques are not considered in this method, which is regarded as one of the ambiguities and the main drawbacks of this method.

Ying et al. (2017) offer the Virtual Reality-based Education eXpansion (VREX) training platform, a combination of online and offline models, to improve the curriculum and teaching experience in higher education. Virtual reality (VR) is the essential component of this platform. Aiming to enhance curriculum efficacy in an immersive environment by allowing students to have an intuitive understanding of abstract knowledge that is difficult for teachers to express, it has been used to improve the effectiveness of the curriculum in an immersive environment. The slides are converted into VR sceneries in this method, allowing students to observe and study in a real but utterly virtual environment. VREX also offers a distributed model that will enable students to participate in the interactive learning process from any location at any time. The combination of augment reality (AR) and mixed reality (MR) is not supported by this approach, which is a disappointment."

Rahmani et al. (2021) in their study enables academic institutions to rethink their distant learning tactics to minimize resources and expenses while simultaneously increasing effectiveness without compromising the quality of their learning and teaching models. Rahmani et al. (2021) discusses the role of the IoT as the primary tool for e-learning at the graduate level. An IoT platform for educational processes was proposed by automatically tracking student activities and behaviors:

- Providing a practical framework for IoT-based e-learning;
- Determining the impact of the IoT on e-learning systems;
- Evaluating the performance of the IoT-based education process through a questionnaire.

Martin et al. (2019) have discussed about the forecasting the impact of learning technologies in engineering education worldwide surveys of 2013, 2014, 2015 in the short, medium and long term. Lei et al. (2018) have discussed about the design and implementation of web based hybrid laboratory framework for research and education purpose. Prieto et al. (2018) have discussed about the development of educational software for specific engineering applications for improving comprehensive learning. Aleksieva-Petrova et al. (2019) have analyzed various ICT tools and their integration into the ICT systems have proved beneficial. Binyamin et al. (2019) have addressed various parameters in the learning management systems and their use in the educational organizations. He et al. (2016) have addressed the issue of designing and addressing the challenges of integrating the IoT based learning framework in the science and engineering disciplines and development of IoT based lab development kits. He et al. (2017) have discussed about the IoT based learning frameworks for addressing learning in undergraduate engineering and science discplines. Chacon et al. (2018) have addressed the isssue of experimential education with IoT based mobile devices for civil engineering programme. Matabuena et al. (2018) have addressed the implementation of MQTT protocols in Labview platforms to address students training under the IoT paradigm. Hung and Chang (2017) have proposed intelligent cloud control system and demonstrating an educational IoT case study by using the system in the practical real time learning environment. Ning and Hu (2012) have proposed two models for future IoT with tracing the relationship between the IoT and science and technology systems with analysis of relevant and related subjects. Maenpaa et al. (2017) have discussed about building of IoT devices and prototypes for teaching computer science engineering and software engineering subjects in a practical problem based teaching and learning experiences. Bagheri and Movahed (2016) have analyzed the research potential of IoT based projects in education and have classified it into different categories like monitoring students health care, improving the teaching and learning process management of energy systems and monitoring of real time ecosystems. Rodríguez et al. (2018) have defined and implemented the capability of Raspberry Pi for creating application that can be reachable from the mobile devices for answering questionnaire by the students from their mobile devices itself in a dynamic classroom scenario. Burd et al. (2017) have done a practical study about the current state of IoT in educaiton and developing interviews with the educators helping the educators in the integration of IoT and its applications in the computer science curriculum. Guo et al. (2019) have proposed the incorporation of advanced robot based curriculum education for comprehensive robot training and education in the IoT majors and related subjects. Raikar et al. (2018) have discussed about the emergence of IoT in curriculum particularly the engineering courses and its integration as proposed in the network for the inclusion of IoT in all the engineering courses. Gunasekera et al. (2018) have proposed an IoT infrastructure for supporting the agricultural and sciences university education as a software design and implementation of the IoT solutions. Johnsson and Magnusson (2017) have introduced a novel inverted developmental approach towards the development of GUI tools for creating, editing, rendering and interpreting GUIs in a number of ehealth domain of research projects. Palani (2020) have covered the platforms of Internet of Medical Things by describing the fundamental GUI application designs to examine the real world issues in terms of performance, portability and robustness in designing the software’s for the medical domain. Marquez et al. (2016) have proposed a model for integrating the IoT in the virtual academic communities and showed that IoT provides a more fruitful environment for the learning process to take place with the students and the teachers. Al-Emran et al. (2020) have striven to highlight the importance of IoT in education, medical education and training and vocational education and training systems, green IoT in education and wearable devices used in the education systems with the analysis of the research being in its early stages and has a long way to go. Besari et al. (2017) have researched and developed an android based mobile application for easy development of the IoT application with the Android visual programming and Raspberry Pi development platform. Nehru, Chakraborty (2019) have discussed about the adoption of IoT in the education for improvement of teaching and learning process in the education systems and infrastructure and termed it as Education of Things. Palattella et al. (2018) have discussed about F-interop for validating the IoT implementation protocols in a fast manner for different IoT standards. Serrano, Gyrard (2016) have discussed about the various approaches in the semantic web for enriching the IoT rich data analytics. Johnsson et al. (2016) have discussed about the need and the use of new approach for building the Android GUIs for IoT based systems for android development. Mahapatra et al. (2018a) have discussed about IoT mashup tools for effective graphical flow based programming to deal with stream processing in a smooth and effective manner. Mahapatra et al. (2018b) have studied and focused on the effective data integration capabilities with data analytics and IoT mashup tools and examining a wide range of data interfaces and APIs in the Java Spark ecosystems. Ryabinin et al. (2018) have developed an ontology based scientific visualization tools for calibrating and monitoring various IoT devices for both visualization of data and device behaviour monitoring. Bagheri and Movahed (2016) have discussed about the application of IoT and sensing technology in the educational domain like monitoring of students classroom activities, teaching and learning process, healthcare and real time classroom monitoring etc. Ma et al. (2018) have discussed about the internet of things security based applications for the secure education and have listed out the various IoT based threats along with proposing of the framework for the e-learning systems. Maksimovic et al. (2017) have proposed the green IoT for engineering educational systems specifically in the smart classroom environments. Majeed and Ali (2018) have discussed and proposed a model for making university campuses smarter using the IoT technology by integrating the internet based communication between physical objects, controllers and sensors with the aim of delivering smart education to the students. Mahmood et al. (2019) have explored the applicability of the raspberry pi development board for the teaching advances with IoT technologies and its environments and have proposed a low cost, efficient and flexible platform that would assist the teaching and learning process by using the learning management systems at par with the IoT technology. Ramlowat and Pattanayak (2019) have addressed the significance of the IoT technology in the educational domain for improving the efficiency of the teaching and learning process with its implementation in the various aspects of the education subjects like computer science education, medical education, distance education, green education etc.

Abbasy and Quesada (2017) have discussed about the IoT in the development of the intelligent e-learning systems for predicting and determining the educational needs of the students based on various connected object databases. Suduc et al. (2018) have discussed about the use of IoT in improving various school operations and have conduced the survey with the university students to determine the impact of the IoT technology. Tripathi and Ahad (2019) have discussed about the applications of IoT in the pedagogical advancement and knitting the gaps between the virtual and physical world with the use of IoT enabled educational environment for making the teaching and learning process better. Bayani et al. (2017) have discussed about the benefits of e-learning in smart cities with smart education systems applications in smart city campuses. El Morr (2019) have discussed about the internet of things and machine learning for advancing applications of the virtual health community in the mental healthcare application domain. Nehru, Chakraborty (2019) have discussed about the value of IoT in the educational system and infrastructures and its impact in the future teaching and learning processes. Tripathi and Haq (2020) have discussed about the role of big data analytics in the development of business oriented education systems for sustainable education systems. Ning, Hu (2012) have discussed about the analysis of the IoT along with the science and technology education systems for building the future IoT system architectures. Santos et al. (2013) have discussed about the GUI based augmented reality applications in educational settings of all levels and have explained its use in various handhel devices equipped with various sensors with augmented reality based tangible user interfaces. Verbert et al. (2012) have worked on the context aware based recommender systems for use in enhanced learning and have pointed out the need for the creation of smart user interfaces to be used in the recommender systems. Chin et al. (2014) have build a educational robot based learning systems for enhanced performance in student learning and motivation. Schneider et al. (2010) have worked on building tangible user interfaces for problem solving tasks in the education domain. Ibanez et al. (2015) have discussed about the Augmented reality based simulation systems for building learning tools for science teaching and learning experiences. Schneider and Blikstein (2015) have focused on the significance of the tangible user interfaces for the future learning of the students. Magnisalis et al. (2011) have discussed about the importance of the collaborative learning environment support by building the adaptive and intelligent systems and their impact on the student learning processes. De La Iglesia et al. (2014) have discussed and designed collaborative mobile learning multi agent systems for improved learning processes. Saxena et al. (2019) have proposed an IoT based systems for enhanced learning of students based on their preferences and comfort level. Bahuguna et al. (2018) have discussed about the augmented reality based smart learning on android platforms. Khari et al. (2019) have presented a proposed work for security challenges in IoT with cryptograhic techniques used in encryption of confidential data in the medical domain. Vimal et al. (2020a) have proposed reinforcement learning based enhanced resource allocation techniques in IIOT. Vimal et al. (2020b) have proposed optimization techniques for energy constrained devices in IoT to enhance its utilization.

IoTs is the most important improvements in universities and classrooms which enables to create smarter lesson plans, preserve majority of basic resources, improves acceptance records, plan a more secure campus. Some of the most important educational applications of the IoTs are covered and how it is made use of , as follows (Gubbi et al., 2013; Lee & Lee, 2015; Amasha et al., 2020):

- Poster Boardsto IoTs-enabled Boards. Web gear like Glogster has changed this issue and allows us to make digital posters with photos, sound, video content and hyperlinks, as well as enables us to distribute them electronically with others. These virtual posters can be shared with others through email, accessed through the publication's URL management and posted on online classjournals.
- Interactive Gaining of Knowledge. Knowledge nowadays is becoming not limited to the blending of writings and pictures but the majority of course books are combined additional substances, films, tests and movements to aid learning. This gives students ability to analyze new topics with a better understanding and interchange with instructors and friends.
- Learning Anytime and Anywhere. The IoTs using unique web-based frameworks. The IoTs enables students and educators to interact together by means of very unusual way, checking messages and up-and-coming occasions when far from the study hall in addition to answering posts. Edmodo is an incredible method for verbal interchange, making it feasible for newcomers to take advantage of data from any area whenever they need. Edmodo is a powerful application that offers safe systems and complete protection, and that enables clients to save particular contemplations without stress while guaranteeing full secrecy.
- Superior Safety Features. This application of the IoTs as superior technology tool inside school rooms and training zones may be helpful. The safety features of the IoTs incorporate crisis pointers, sound improvement, Wi-Fi timekeepers and hearing-impaired notices that offer researchers and specialists with a sentiment of security. Universities focuses are embracing explicit safety efforts that help to unwind the grounds. The IoTs empowers interchange frameworks likewise used for different cases, such as exceptional crisis tones, live releases, and pre-recorded instructional messages so as to coordinate the gathering of workers and students in urgent situations.

3.3. Internet of Behaviour (IoB) and IoB platforms

The Internet of Behaviours (IoB) is a subset of IoT that tries to address user behaviors and so help us assess how data may be better understood and exploited to design and give education services to students from a psychological standpoint (Halgekar et al., 2022). The Internet of Behavior (IoB) is a term that refers to the collecting of data that gives crucial information about a user's behavior, interests, and preferences (Elayan et al., 2021). The IoB platform enables academic institutions to understand their pupils fully. IoB, for example, connects all mobile phones in the app, allowing users to monitor their swing and stroke defects and receive visual tips on how to improve them.

There is a growing body of research on the Internet of Behavior (IoB) and how it might help businesses understand their customers better (Elayan et al., 2021). The IoB platform helps academic institutions fully comprehend their pupils. By connecting all phones in the app, users can see their swing and stroke problems and get visual suggestions on how to fix them.

However, very few studies focus on how to leverage the internet of behaviours (IoB) to personalize learning content and how IoB can be used to monitor students' behaviour that affects their attainment, progression, and performance. This work will demonstrate a proposed paradigm for integrating explainable artificial intelligence (XAI) and the internet of behaviour (IoB) to tailor learning content to students' cognitive abilities and automate academic progress tracking (Embarak, 2022).

Embarak (2022) employed a combination of the IoB and XAI to create trustworthy and intelligible frameworks that operate in the education domain where users' behaviour changes. Author offers an IoB-based XAI-based system for use in the education sector to change users' behaviour toward an eco-friendly one to maximize the learning attenuation and robust student's academic progression. This framework incorporates IoT, AI, Data Analytics, Behavioral Science, and XAI approaches to deliver smart, adaptable education. The following summarizes the author's contributions:

- Proposed a trustworthy and understandable IoB-XAI-based education system capable of influencing and changing learners' habits and behaviour for their educational benefit.
- Provided a scenario illustrating the learner's behaviour inside the class, practicals, and other related activities to create knowledge about the importance of controlling a student's progression.
- Compared and contrast the primary characteristics of existing systems and the proposed paradigm.

This study analyzes how explainable artificial intelligence and the Internet of Behaviors may be used to adjust and alter learning materials to students' cognitive capacities and requirements, despite other studies having sought to explain how educational advancements occur (Embarak, 2022).

3.4. Cognitive IoT-based e-learning systems analysis and related platforms

The Internet has created a globalized world in which people consume, produce, and communicate information in different ways overcoming physical boundaries limitations. Broadband connectivity access and rapid technological development led to exponential adoption of digital solutions in many sectors. The beginning of the 21st century witnessed the emergence of e-learning platforms. This encouraged education leaders to push learning beyond school walls and engage people in lifelong learning journeys (Zaguia et al,, 2021).

Over the last decade, e-learning has shown significant growth, as the Internet, technologies, and education combine to provide people with the opportunity to gain new skills. Since the COVID-19 outbreak, most governments around the world have closed educational institutions in an attempt to contain the spread of the virus. Globally, over 1.2 billion children are out of the classroom. This underlines why online learning has become more important in people's lives. As a result, education has changed dramatically, with the distinctive rise of e-learning, whereby teaching is undertaken remotely and on digital platforms. Even before the pandemic, there was already high growth and adoption in education technology with global investment reaching 18.66 billion US dollars and markets forecast the online education as 350 billion dollars industry by 2025, which might be updated after analyzing the impacts of COVID-19 (Chen, 2020) on the online learning market (Zaguia et al., 2021).

Online learning is becoming a huge catalyzer for people and companies to help the adoption of the dynamic and fast change in the world. As they provide many advantages such as time convenience or being cost-friendly, the online courses offer a more affordable option than traditional systems. Despite the rapid adoption and development of e-learning, the e-learning system, platforms, and solutions still face many issues to improve the users-centered experiences (Zaguia et al., 2021).

Context-awareness enhances the system's capabilities to enable the learning environment by intelligent monitoring and adaptability to the user's needs with awareness to his environment based on real-world observation considering the user's specific context. Furthermore, including intelligent modules and supporting different human-machine interaction approaches based on IoT (Pradhan et al., 2021; Hameed et al., 2021) and ambient intelligence can help provide an efficient learning experience. Thus, we aim to enhance the e-learning systems with context-awareness capabilities and intelligent modules to assist its users (Zaguia et al., 2021).

During the last decade, the domain of e-learning has grown quite fast. Many known learning management systems (LMSs) were implemented and diversified enjoying the reliance on various methodologies and efficient algorithmic developments (Jones, 2006; Alturki et al., 2016; Beriswill, 2018). In such systems, an e-learning environment will be shared to the learners through their personal devices. These systems enable learners to interact and collaborate with other learners and teachers to realize their assessments and a specific educational task. These systems are characterized by the ability to interact in the harmonious way with the learners (Truong, 2016).

The authors in (Perales, 2019) presented an online system used at the International University of La Rioja that has about 30,000 enrolled students. The online system is a remote virtual laboratory, which provides a practical education by using tools for experimentation in engineering education. The instructor can move from one online working space to another to help students solve their lab instructions. This system is essentially used to offer online laboratories. However, this system does not take into consideration the interaction and the student's contexts.

The authors of (Soonthornphisaj et al., 2006; Mayer, 2017; Sarwar et al., 2019; Oxana et al., 2019) presented e-learning systems enabling the users to chat, talk, and share information including video, shared applications, and audio. These systems are not conceived to be smart and user-centered. The authors of (Jih & Hsu, 2009; Asabere, 2013; Sabagh & Al-Yasiri, 2015; Zaguia et al., 2015; Ye et al., 2016; Tarus et al., 2018) proposed the use of the context-awareness system collecting a large volume of information about the learner's environment. According to these data, the system will automatically adapt to the user's preferences. The integration of the context-awareness in the e-learning system will be an efficient technique to enhance learning.

The authors (Udupi et al., 2016; Lone et al., 2018; Ali et al., 2018; Gogo et al., 2018; Gleich et al., 2020; Priyahita, 2020,) in suggested using artificial intelligence (AI) techniques, such as data mining and fuzzy logic, to enhance the e-learning strategies with a smart way and augment interactions between learners. Most of these systems limit the context to the learner's assessment score, the time needed to complete the assessment test, histories, etc.

Zaguia et al. (2021) propose an IoT-based smart learning system architecture, including entity-based model and its function view incorporating the context-awareness modules. We also present the model's implementation plan supported by a simulation to prove the concept and functionality of the proposed system.

According to Zaguia et al. (2021), the existing e-learning platforms and systems still face a lack of multiple key factors for a successful, efficient, and customized learning experience. They mention as an example the lack of (i) an immersive experience, (ii) smart assistance for the learning activity, (iii) efficient interactivity between the students and the learning provider, and (iv) services proactivity including predicting the needs of the users. These limits should be overcome while ensuring a transition from e-learning to smart learning. This transition can be enabled by context-awareness, an IoT-based monitoring approach, and intelligent modules for users' assistance.

4. Text Analytics for INCLUDE Project

Text mining, sometimes alternately referred to as text data mining, roughly equivalent to text analytics, refers to the process of deriving high-quality information from text. High-quality information is typically derived through the divining of patterns and trends through means such as statistical pattern learning. Text mining usually involves the process of structuring the input text (usually parsing, along with the addition of some derived linguistic features and the removal of others, and subsequent insertion into a database), deriving patterns within the structured data, and finally evaluation and interpretation of the output. 'High quality' in text mining usually refers to some combination of relevance, novelty, and interestingness. Typical text mining tasks include text categorization, text clustering, concept/entity extraction, production of granular taxonomies, sentiment analysis, document summarization, and entity relation modeling (i.e., learning relations between named entities) (Machine Learning Market, 2013).

Text analytics software can help by transposing words and phrases in unstructured data into numerical values which can then be linked with structured data in a database and analyzed with traditional data mining techniques. With an iterative approach, an organization can successfully use text analytics to gain insight into content-specific values such as sentiment, emotion, intensity and relevance. Because text analytics technology is still considered to be an emerging technology, however, results and depth of analysis can vary wildly from vendor to vendor (BusinessAnalytics, 2013).

Text analytics is the process of deriving information from text sources. It is used for several purposes, such as: summarization (trying to find the key content across a larger body of information or a single document), sentiment analysis (what is the nature of commentary on an issue), explicative (what is driving that commentary), investigative (what are the particular cases of a specific issue) and classification (what subject or what key content pieces does the text talk about) (Gartner).

Text mining is the activity of obtaining information resources relevant to an information need from a collection of information resources. Searches can be based on metadata or on full-text indexing. Text mining is vast area as compared to information retrieval. Typical text mining tasks include document classification, document clustering, building ontology, sentiment analysis, document summarization, Information extraction etc. Where as information retrieval typically deals with crawling, parsing and indexing document, retrieving documents (Stackoverflow, 2013).

Text mining concerns itself with discovering structure and patterns in unstructured data – usually text. There are many different approaches to this task, some focus on ancillary structures such as taxonomies and ontologies, some focus on semantics and natural language processing, while others use various algorithms to categorise and summarise. For example, KNIME Text Processing is a plug-in to the (free) KNIME data mining suite supports a six step text processing process which starts with the reading and parsing of text, followed by named entity recognition, filtering and manipulation, word counting and keyword extraction, bow and vector representation, and finally visualization (Butleranalytics, 2013).

Presently, text mining is in a loosely organized set of competing technologies that function as analytical "city-states" with no clear dominance among them. To further complicate matters, different areas of text mining are in different stages of maturity. Some technology is easily accessible by practitioners today via commercial software, while other areas are only now emerging from academia into the practical realm (Miner et al., 2012).

Research shows that various researches have specialised in depth the different and very important areas of text analytics and mining (blogs and social networks (Boulos et al., 2010; Shenghua & Li, 2013; Mostafa, 2013; Marwick, 2014), students' online interaction (He, 2013), digital libraries (Nguyen, 2014; Fagan, 2014), process industry (Liew et al., 2014), medicine (Anholt et al., 2014), legal, business intelligence, security (Truyens & Van Eecke, 2014), etc. A brief analysis of above research follows.

Social media have been adopted by many businesses. More and more companies are using social media tools such as Facebook and Twitter to provide various services and interact with customers. To increase competitive advantage and effectively assess the competitive environment of businesses, companies need to monitor and analyze not only the customer-generated content on their own social media sites, but also the textual information on their competitors' social media sites. The results reveal the value of social media competitive analysis and the power of text mining as an effective technique to extract business value from the vast amount of available social media data. Recommendations are also provided to help companies develop their social media competitive analysis strategy (Shenghua & Li, 2013).

Marwick (2014) investigate the use of Twitter at a major conference of professional and academic anthropologists. Using R Marwick (2014) identify the demographics of the community, the structure of the community of Twitter-using anthropologists, and the topics that dominate the Twitter messages. A key finding is that the transformative effect of Twitter in academia is to easily enable the spontaneous formation of information-sharing communities bound by an interest in an event or topic (Marwick, 2014).

Blogs and social networks have recently become a valuable resource for mining sentiments in fields as diverse as customer relationship management, public opinion tracking and text filtering. In fact knowledge obtained from social networks such as Twitter and Facebook has been shown to be extremely valuable to marketing research companies, public opinion organizations and other text mining entities. However, Web texts have been classified as noisy as they represent considerable problems both at the lexical and the syntactic levels. Mostafa (2013). Mostafa (2013) research results indicate a generally positive consumer sentiment towards several famous brands. By using both a qualitative and quantitative methodology to analyze brands' tweets, Mostafa (2013) study adds breadth and depth to the debate over attitudes towards cosmopolitan brands.

Boulos et al. (2010) explore Technosocial Predictive Analytics (TPA) and related methods for Web "data mining" where users' posts and queries are garnered from Social Web ("Web 2.0") tools such as blogs, micro-blogging and social networking sites to form coherent representations of real-time health events. Boulos et al. (2010) introduce to commonly used Social Web tools such as mashups and aggregators, and maps their exponential growth as an open architecture of participation for the masses and an emerging way to gain insight about people's collective health status of whole populations.

Students' online interaction data suggests that a combination of using data mining and text mining techniques for a large amount of online learning data can yield considerable insights and reveal valuable patterns in students' learning behaviors (He, 2013).

With the availability of open and structured data, digital libraries become an important source of data in recent data mining techniques. The inherent structure of digital libraries comes with information about date, authorship, involved institutions, geographic context, and large volumes of text (Nguyen, 2014). As an illustration of digital libraries analysis, Nguyen (2014) focus on a space of scientific publications related to some science discipline and extract patterns and text-related information from the dataset. Nguyen (2014) discuss text preparation techniques in R, the use of the latent Dirichlet allocation to classify content, and the analysis of text features, like co-occurrence matrices. Simple similarity measures between authors and between papers is used to illustrate cluster cohesion within the dataset (Nguyen, 2014).

As the demand for library assessment grows, academic libraries are becoming more interested in Web analytics. Data are automatically gathered and provide information about a wide variety of online interactions (Fagan, 2014). Fagan (2014) discusses how commercial web metrics might be adapted for use in academic libraries. Major key performance indicators used in the commercial sector are reviewed in the academic library context (Fagan, 2014).

Four main sectors of the process industry are studied by Liew et al. (2014): oil/petrochemicals, bulk/specialty chemicals, pharmaceuticals, and consumer products. Liew et al. (2014) study reveals that the top sustainability focuses of the four sectors are very similar: health and safety, human rights, reducing GHG, conserving energy/energy efficiency, and community investment.

The so-called text or data "mining" enables this huge amount of medicine information to be managed, extracting it from various sources using processing systems (filtration and curation), integrating it and permitting the generation of new knowledge (Piedra et al., 2014). Using commercially available text-mining software (WordStat™), Anholt et al. (2014) developed a categorization dictionary that could be used to automatically classify and extract enteric syndrome cases from the warehoused electronic medical records (Anholt et al., 2014).

Currently authors participated in the INCLUDE (INCLUsive Disaster Education) project. Already existing above text analytics and text mining cannot develop text material alternatives (perform a multivariant design), perform multiple criteria analysis, automatically select the most effective variant according to different aspects (popularity of a text (citation index of papers (Scopus, ScienceDirect, Google Scholar, etc.) and authors (Scopus, ScienceDirect, Google Scholar, etc.), Top 25 papers, impact factor of journals, supporting phrases, document name and contents, density of keywords), calculate utility degree and market value. However, the Text Analytics for INCLUDE Project can perform the aforementioned functions. To the best of the knowledge herein, these functions have not been previously implemented; thus this is the first attempt to do so.

The essence of this research involves the Text Analytics Model that is designated to select the most rational, integrated text material from a library of documents. It covers the inputting of bag of concepts space; selecting, processing and indexing information in accordance with the inputted bag of concepts space and User Model; formulating the results of the retrieval and finally showing them to the user. Further, after selecting, processing and indexing documents, it covers the selecting out of composite parts (chapters/sections/paragraphs) of the documents under analysis and, after that, performing the multi-criteria analysis of the composite parts. This is followed by the designing of alternative variants of the selected information and performing a multi-criteria analysis of the summarised integrated alternatives of the text by which the retrieval results are then formulated.

Once the selecting, processing and indexing of information has been completed, the selecting out of the composite parts of the documents and their multi-criteria analysis are performed. Further alternative variants are designed, these are analysed and the most rational alternative is selected. All this makes the text analytics system more flexible and more informative, since it selects out electronic information as much by area as by coverage.

The multi-criteria analysis of the most rational text materials from a library of documents under analysis covers the complex determination of criteria weights taking into account their quantitative and qualitative characteristics. It includes a multi-criteria evaluation of the text materials defining the utility and market value of the text materials.

Text Analytics Model permits selecting the maximally rational information in the coverage that the user desires. The designing of alternative variants provides the user with an opportunity to supplement and/or correct the already inputted bag of concepts space, modify the weights and then repeat the search. In other words, the user by using User Model is provided an opportunity to intervene in the occurring retrieval and to redirect it; thus the retrieval takes into account the user-selected priorities and the existing situation.

The designing of alternative variants from the selected text materials contained in a library of documents covers the following stages: a) development of a table of codes of text materials from a library of documents, b) rejection of inefficient versions, c) computer-aided development of summarised, integrated text alternatives based on the codes compiled during Stage a), d) development of summarised, integrated text alternatives and the conceptual and quantitative information describing them and e) development of a summary decision-making table of all the obtained summarised, integrated text alternatives and relevant conceptual and quantitative information overall.

At the beginning of a search, a user is able to submit the following kinds of search requirements: The user indicates the goal or goals for the search – research, practical or cognitive. The user notes the possibilities of interest to him/her while conducting the search: research literature (books, academic articles and the like), practical literature or popular literature; the user requests or selects bag of concepts space (Fig. 4.1); the user establishes various limitations (volume of the material under search by pages, desired time for reading a lecture by minutes and the like).

To limit the amount of search results showing the pages that include the concepts in question (or to restrict the search by the duration of reading), tick the option Advanced search options below the button Search. Additional fields appear: Aproximately ... pages and Approximately for: ... minutes. You will also see round buttons to choose search either by the number of pages (default) or by the duration of reading.

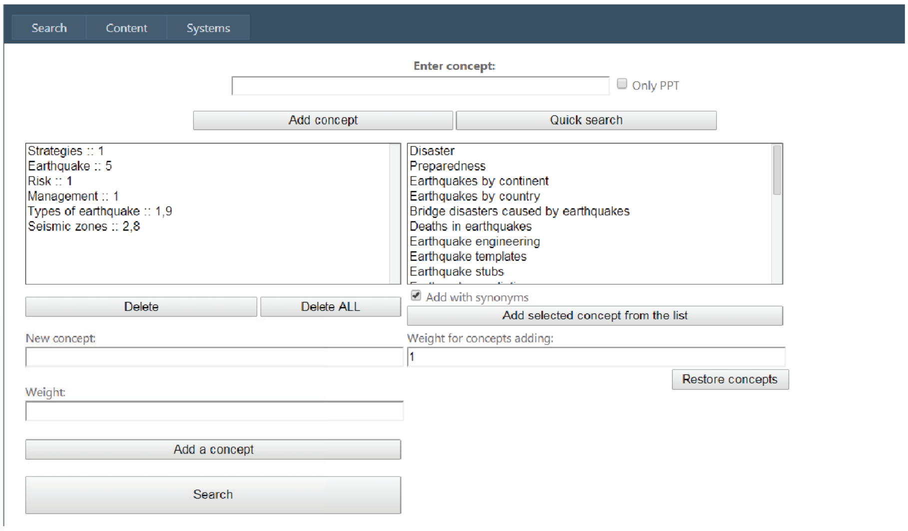


Fig. 4.1. User window of the Text Analytics for the INCLUDE Project.

The Agent subsystem accumulates information about a user and stores his/her individual data. This information can be explicit (year of birth or university graduation) or implicit. The main skills of a user are implicit. They consist of informal and unregistered knowledge, practical experiences and skills. Such data are very important because they describe a user's experience. Information about a user's existing education, needs and the like accumulate in the Agent subsystem.

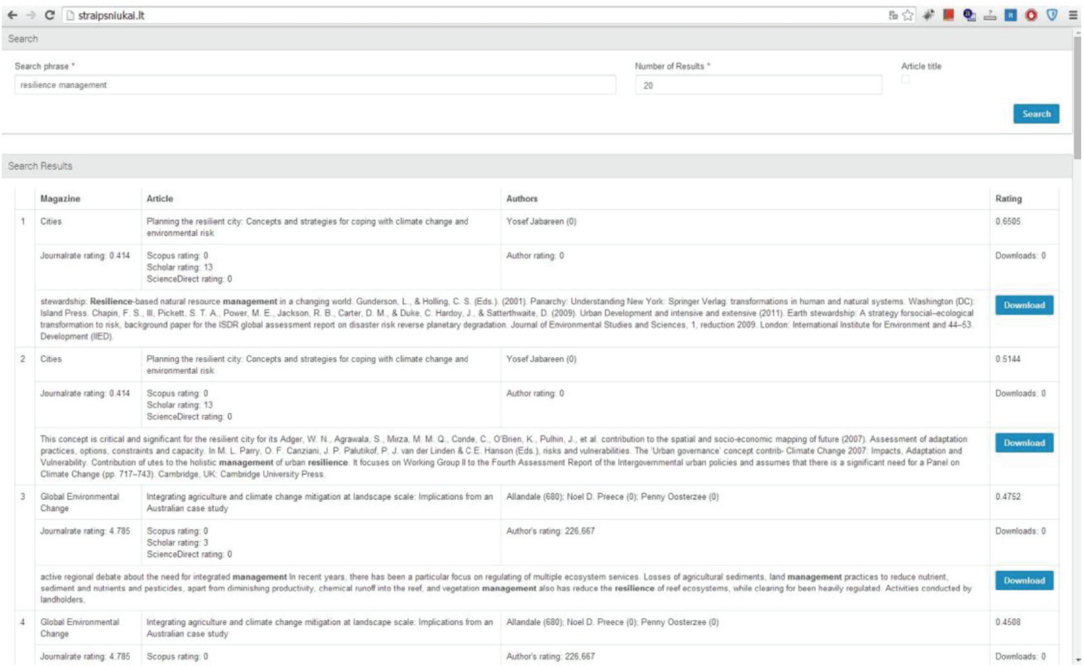
As a user's historical search information is being analyzed, his/her initial search requirements can be refined (or made more specific). In this case, the user's behavior is under analysis; for example, which documents the user does or does not select for review, how often a document is viewed and how much time is spent looking at it along with use of the drag function are all under observation. This may partially be called the analysis of user conducted searches, the agent function.

The Agent subsystem accumulates statistical information about the previous searches conducted by a user in a matrix form: bag of concepts space of a search; results of a search; how many times a user modified the initial search before suitable results were gained; the most popular resources and Internet website addresses employed by the user; how many times did a user read the selected material and how much time was spent doing so.

This way the automatic search is actually personalized by applying the historical information gathered by the Agent subsystem: bag of concepts space under search is refined (or made more specific); information about the user's education, work experience and search needs are considered; the user's most frequently employed resources, Internet website addresses and authors are considered; the user's opinion regarding the significance of the documents gained by the results of a search are considered.

The following factors determine a rational text:

- Citation index of papers (Scopus, ScienceDirect, Google Scholar) (Fig. 4.2)
- Citation of authors (Scopus, ScienceDirect, Google Scholar, etc.) (Fig. 4.2)
- Top 25 papers
- Impact factor of journals (Fig. 4.2)
- Popularity of a text (citation index, number of readers, time spent reading)
- Reputation of the documents
- Supporting phrases
- Document name and contents
- Density of keywords



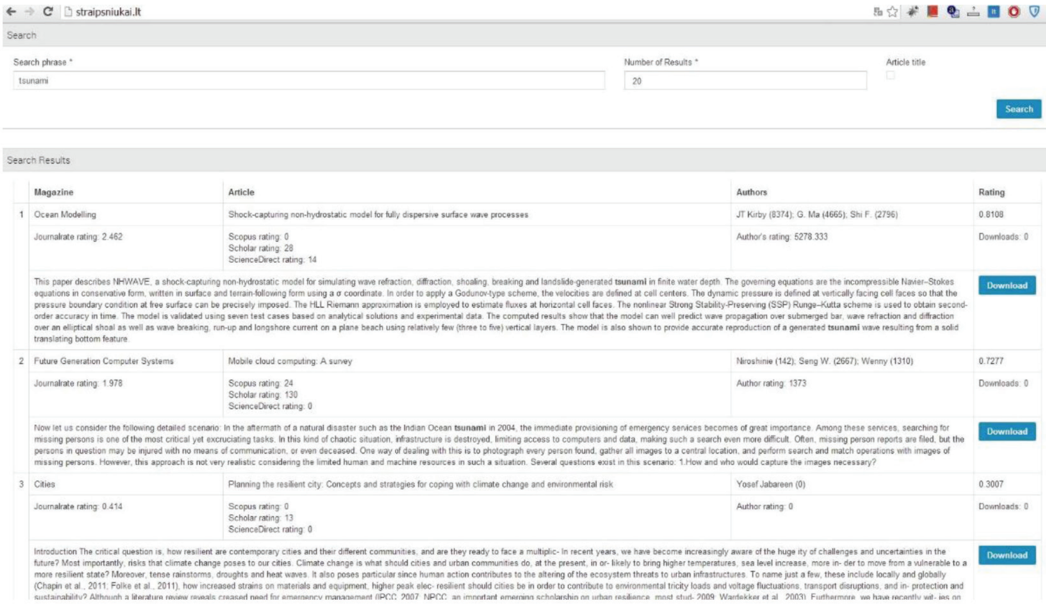


Fig. 4.2. User window of the Text Analytics for INCLUDE Project for the analysis of the citation index of papers (Scopus, ScienceDirect, and Google Scholar), citation of authors and impact factor of journals.

The system was developed as Web application using Microsoft Visual Studio 2010 (.Net Framework 4), C# as a main programming language and MS SQL Server 2012 as database platform. An example of the fragment of the rational text analytics result is presented in Fig. 4.3.

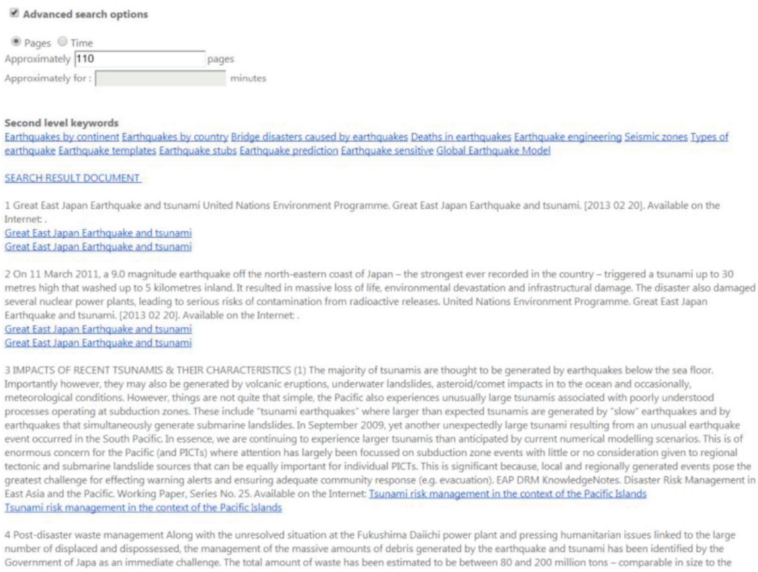


Fig. 4.3. Fragment of a User window of the Text Analytics for the INCLUDE Project results.

5. Generic specifications for the Online research repository with open educational resources platform

In a comprehensive research done by UK academics (https://doi.org/10.1038/s41591-020-1011-4), it has been identified that sharing of virus sequencing data using open repositories during COVID-19 has increased the speed of data sharing not seen in previous global outbreaks. As such, quick and open access to research data is vital to developing preparedness for future disasters and in tackiling COVID-19 and other biological hazards related shocks. In this context, the research repository that is planned as O5 will have number of objectives;

1. Encourage research among underrepresented communities (in the EU and also elsewhere) by providing access to world class DRR research through an open access repository.
2. Medium to share, showcase DRR research and educational material easily, and increase stakeholder visibility.
3. Enable and promote lifelong learning within the DRR community by strengthening research capacity.
4. A platform to share unpublished work such as datasets, dissertations, reports, case studies, multimedia content in DRR etc.
5. Maintain long-term preservation and accessibility to DRR related research outputs.

In order to achieve the above mentioned objectives, the envisaged repository will be built with following features;

1. Full stack web solution with a database, management tools and a front-end web user interface. Open source repository technology such as Fedora, DSpace, Eprints will be considered to ensure the repository is free and accessible to all DRR community.
2. Simplified workflow for submitting datasets, with suitable gate keeper and curator functions.
3. Ability to support widely known metadata schemes such as QDC (Qualified Dublin Core), MARC (Machine-Readable Cataloguing) etc. This ensures transfer of existing data from other repositories.
4. Facility to both search and browse content.
5. Ability to upload wide variety of file types including PDFs, images, videos and other multimedia file types.
6. Security services such as authentication, setting user permissions, setting administrative rights etc.
7. Security of data such as ability to back-up and recover data.
8. Ability include features (but not limited to) such as; Quizzes for collecting data, and Blogs

The proposed repository will also have numerous impacts and transferable outputs, especially in the areas of research, knowledge creation and dissemination to the wider DRR community.

1. Going beyond the concept of traditional university directional knowledge flow, (from repository to the beneficiaries), feedback knowledge flow (from beneficiaries to the repository), is also envisaged via the incorporation of features such as Blogs, where other stakeholders and interested parties are allowed to contribute to knowledge dissemination. It is expected that a spiral effect will be created for continuous improvement of the online repository.
2. The repository will function as an important digital archival facility for the DRR community, ensuring continuous access to past research and past training material such as; datasets, thesis, webinars, material from workshops etc.
3. The repository will also function as a knowledge creation and a dissemination tool for EU and like-minded international researchers from the DRR community. The system will be updated

frequently with new research publications, case studies, new scientific advancements and emerging technologies related to DRR etc. This will especially be beneficial to researchers from underrepresented countries or communities, because access to world leading research will improve their own research skills and practices. EU researchers will benefit from improved access to DRR research problems and datasets that were previously hard to access, whereby they can broaden their research experience further and develop research infrastructures within their own institutions as well as for EU funded research programmes.

Functional and technical requirements are presented below:

Functional requirements

No.	**Requirements**
1.	Simplified workflow for submitting datasets, with suitable gate keeper and curator functions.
2.	Ability to support widely known metadata schemes such as QDC (Qualified Dublin Core), MARC (Machine-Readable Cataloguing) etc. This ensures transfer of existing data from other repositories.
3.	Facility to both search and browse content.
4.	Ability to upload wide variety of file types including PDFs, images, videos and other multimedia file types.
5.	Security services such as authentication, setting user permissions, setting administrative rights etc.
6.	Security of data such as ability to back-up and recover data.
7.	The cMOOCs platform should be designed to support multiple user devices (PCs, Smart Phones and Tabs) and operating systems (Linux, iOS, Android, Windows).
	Other functional requirements
8.	Open-source MOOCs technology such as Moodle must be implemented, but should be customized to include collaborative tools to support participatory interaction, network building and peer to peer learning.
9.	Open-source repository technology such as Fedora, DSpace, Eprints should be considered to ensure the repository is free and accessible to all DRR community. Due to the complexity of developing new software, priority will be given to integrating third party open-source tools.
10.	Possibility to include services such as Blogs, Wiki, Quizzes etc.
11.	Possibility to enable and promote lifelong learning within the DRR community by strengthening research capacity; and share unpublished work such as datasets, dissertations, reports, case studies, multimedia content etc. between and within different academics and researchers in the DRR field.

Technical requirements

No.	Requirements
	Graphical interface
1.	The user must use the platform through a graphical interface, where data and platform control commands are presented on the computer screen in graphically arranged fields, tables, and pictures in program windows.
2.	The user's graphical interface must be implemented on the principle of dialogue, when the platform can provide the user with information and several options from which the user must choose.
3.	The graphical user interface must be implemented in English.
4.	The INCLUDE platform's graphical user interface must be implemented in an Internet browser environment. It must be compatible with the most popular Internet browsers (Microsoft Internet Explorer, Firefox, Opera, or equivalent).
5.	When the user enters data, some must be automatically filled in on the INCLUDE Online research repository with open educational resources platform (e.g., data submission date, user data), where it must be possible to determine this unambiguously.
6.	The functionality of the INCLUDE Online research repository with open educational resources platform must allow the sorting of data according to selected parameters (parameters will have to be adjusted during the analysis and design of the implementation project).
7.	The functionality of the INCLUDE Online research repository with open educational resources platform must allow searching for records according to selected parameters (parameters are refined during analysis and design).
8.	The graphical user interface of the INCLUDE Online research repository with open educational resources platform must run on Microsoft Windows XP (or equivalent).
9.	INCLUDE Online research repository with open educational resources platform menu navigation structures and design could be refined during design.
10.	Functionality ensuring ease of use must be implemented: • The arrangement of windows/objects must correspond to the sequence of users' activities; • Realized TAB key sequence when passing through input fields; • Hints must be used (cursor, ToolTips, on mouse over button states, etc.).
11.	Other user comfort measures must be identified and coordinated during analysis and design.
	Online research repository with open educational resources platform administration
12.	User access rights must be managed centrally.

13.	The INCLUDE Online research repository with open educational resources platform is administered using a graphical user interface.
14.	Functionality must be implemented to block unnecessary users without removing them from the database.
15.	The list of actions that the administrator can perform is refined during the analysis phase.
	Speed requirements
16.	The INCLUDE Online research repository with open educational resources platform must not have a limit on the number of users.
	Data quality
17.	The Online research repository with open educational resources platform must implement the functionality of data recording and field-level quality assurance of data managed and entered into the Online research repository with open educational resources platform.
18.	During data entry, the quality assurance functionality should present the verification results to the user in the user window.
19.	Quality assurance and data verification functionality must be linked to the user interface for data entry into the Online research repository with open educational resources platform.
20.	Error messages provided to users of the Online research repository with open educational resources platform must be informative and provide sufficient information for further actions - to eliminate or avoid the error.
	Project requirements
21.	Online research repository with open educational resources platform infrastructure should be the web server (e.g. Apache), databases (e.g. PostgreSQL, Oracle), UI (User Interface) and UX (User Experience) etc. During the project, it must be possible to export data from this database to the Online research repository with open educational resources platform created during the project.
22.	A user manual and support system must be developed for each module of the Online research repository with open educational resources platform.
23.	Each stage of Online research repository with open educational resources platform development must be documented and approved.
24.	Application installation files must be provided on electronic media.
25.	The executor must organize an acceptance test of the modules of the Online research repository with open educational resources platform, in which the customer's employees will participate.

6. Short information about O5 open-access research repository

The O5 open-access research repository (http://iti4.vgtu.lt/include/default.aspx) has a number of objectives:

1. Encourage research among underrepresented communities (in the EU and also elsewhere) by providing access to world class DRR research through an open access repository.
2. Medium to share, showcase DRR research and educational material easily, and increase stakeholder visibility.
3. Enable and promote lifelong learning within the DRR community by strengthening research capacity.
4. A platform to share unpublished work such as datasets, dissertations, reports, case studies, multimedia content in DRR etc.
5. Maintain long-term preservation and accessibility to DRR related research outputs.

O5 focuses on building a data-sharing platform for research outputs. It has the facility to search and browse content and upload a wide variety of file types, including PDFs, images, videos and other multimedia file types.

The repository also have numerous impacts and transferable outputs, especially in the areas of research, knowledge creation and dissemination to the wider DRR community. The repository function as an important digital archival facility for the DRR community, ensuring continuous access to past research and past training material such as; datasets, thesis, webinars, material from workshops etc. The repository also functions as a knowledge creation and a dissemination tool for EU and like-minded international researchers from the DRR community. The system is updated frequently with new research publications, case studies, new scientific advancements and emerging technologies related to DRR etc. This especially is beneficial to researchers from underrepresented countries or communities, because access to world leading research can improve their own research skills and practices.

A literature survey was carried out to study the features of existing research repositories, and open-source technologies used to develop them. The literature survey was the basis for identifying existing methods and gaps in existing technology. Based on the functional and technical specifications finalised from activities 4.1–4.3, the research repository was developed, predominantly using open-source technologies.

The development lifecycle had 4 milestones:

1. The prototype
2. First alpha release for internal testing
3. First beta release for public (partner) testing
4. Final product.

The prototype and the alpha testing was open to the O5 lead, and the first beta release was released to all partners for final comments before finalising the product. User surveys was used to capture feedback and refine the platform.

As part of the first beta release, draft technical manuals and user instructions was prepared to ensure that the platform is easy to maintain and use. User surveys was used to capture feedback and refine the manual.

Launch event for the research repository of O5, and the cMOOCs platform of O3 was conducted as a single event. Event was attended by all stakeholders from all participant countries. The event was conducted online, allowing wider participation. A series of online ‘taster’ training courses and activities was presented at this event.

User surveys

User surveys was used to capture feedback and refine the platform. The efficiency and usability of the O5 research repository for practical applications were established by the user surveys. This way the O5 research repository were evaluated for possibly needed improvements prior to its launch in actual conditions. The black-box testing method was the means used to test the O5 research repository. Results gained during the verification and validation, along with corresponding data, comprised the information provided to the tester. The users were invited to participate in the process involving the validation and verification of the O5 research repository. A questionnaire was used to validate the O5 research repository. There were 8 questions administered which went into the data analysis:

1. Are O5 research repository enable and promote lifelong learning within the DRR community by strengthening research capacity?
2. Can the platform share unpublished work such as datasets, dissertations, reports, case research, multimedia content in DRR etc.?
3. Can the platform maintain long-term preservation and accessibility to DRR-related research outputs?
4. Is it has the facility to search and browse content?
5. Is the system updated frequently with new research publications, case research, recent scientific advancements and emerging technologies related to DRR etc.?
6. Are existing large language models, ChatGPT, text analytics, and text mining can develop text material alternatives (perform a multivariant design), perform multiple criteria analysis, and automatically select the most effective variant according to different aspects (citation index of papers (Web of Science) and authors (Web of Science), impact factor of journals, supporting phrases, document name and contents, density of keywords) and calculate utility degree and priority? Can the Online research repository perform the functions above?
7. Is it these functions appropriate?
8. Are the outcomes delivered by the O5 research repository remarkable to users and stakeholders alike?

The questioning of the participants took place at the end of the experiment, when they filled out the questionnaires to evaluate the O5 research repository. The answers to these questions involved the selection of one option from the four that typically appear on the Likert scale: (1) strongly disagree. (2) disagree, (3) agree or (4) strongly agree. The examination of the answers for calculating standard deviations and data frequencies were accomplished by the SPSS. The scores of the 8 questions fell between 3 and 4 points. Upon completion of this exercise, the recommended O5 research repository improvements by the users were enacted. For one, this user feedback revealed the added benefits of the O5 research repository providing research with inspiration and pleasure. This O5 research repository, according to the users participating in the experiment, could be applied in practice to provide conditions for rationalizing the research process, improving the comfort and valence of the research and increasing research performance while, at the same time, increasing happiness. The reports submitted contain all the assessments pertinent to each review.

The verification and validation process confirmed that the O5 research meet the requirements. The O5 research repository was then put into service.

7. O5 Platform User Manual

Note: Internet Explorer is not fully supported and may cause issues.

To open the O5 platform, use the following steps:

1. Open the O5 platform http://iti4.vgtu.lt/include/ to access the system (Fig. 1).

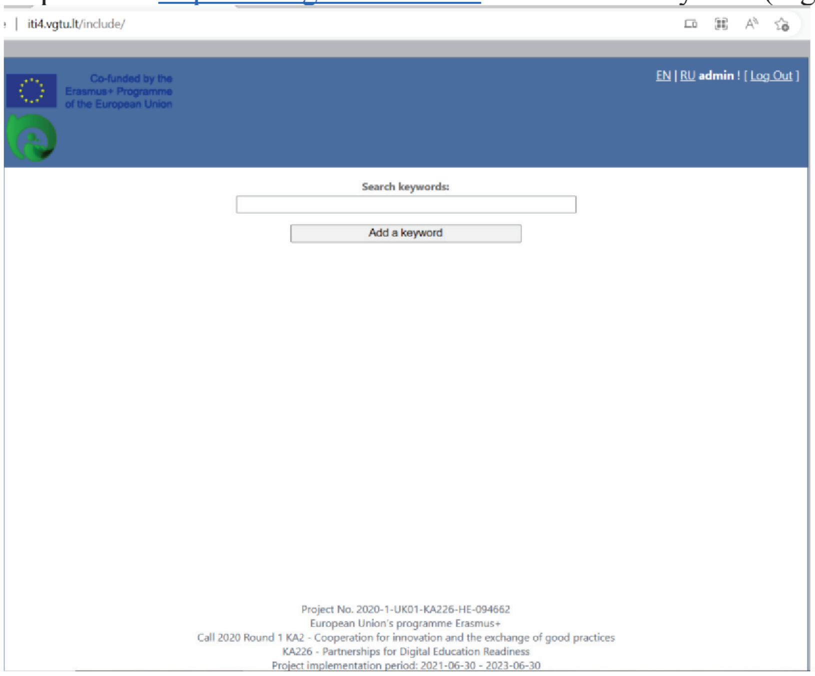


Fig. 1. The O5 platform.

2. For searching the text and scientific publications on DRR subject please press "Add a keyword" and the new window will appear (Fig. 2). In Fig. 2 in the left field "New keyword" you need to enter keyword and attribute to it the **significance** from 1 to 10, then press "Add a keyword". You can add few keywords.

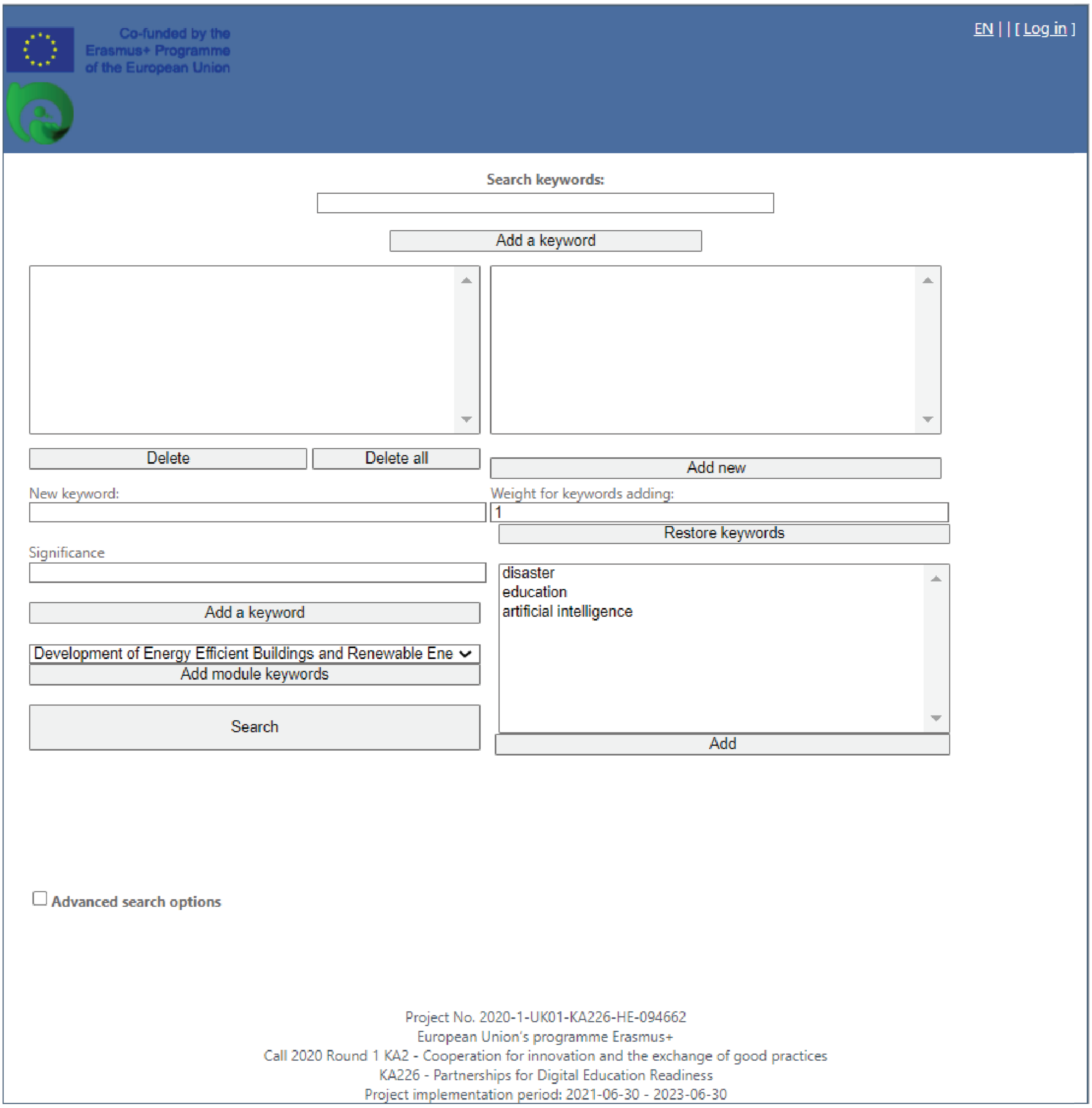


Fig. 2. User window of the O5 platform.

3. After then all keywords will be on the list, it is needed to select Advanced search options and add the number of publications you would like to find (Fig. 3).

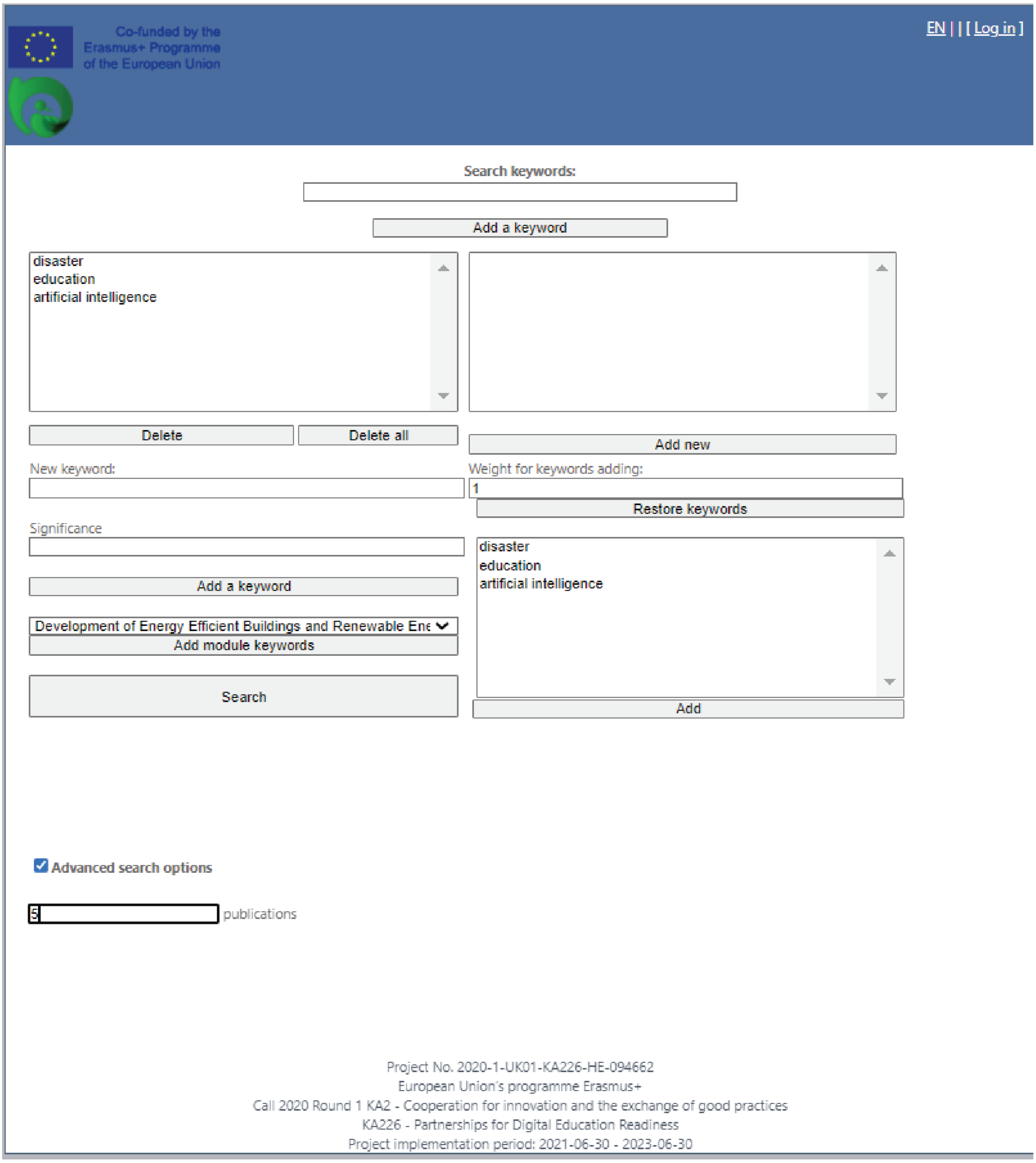


Fig. 3. User window of the O5 platform after all keywords entered.

4. Press Search button.
5. According to selected keywords the system will search for the publications and provide the analysis of them. (Fig. 4).

The following factors determine a rational text:

- Citation index of papers (Scopus, ScienceDirect, Google Scholar) (Fig. 4)
- Citation of authors (Scopus, ScienceDirect, Google Scholar, etc.) (Fig. 4)
- Top 25 papers
- Impact factor of journals (Fig. 4)
- Popularity of a text (citation index, number of readers, time spent reading)
- Reputation of the documents
- Supporting phrases
- Density of keywords

☑ Advanced search options

6 publications

Search result document(PDF)

The following factors determine a rational text:	Publication 1	Publication 2	Publication 3	Publication 4	Publication 5	Publication 6
Citation of papers:						
Citation of papers (Web of Science)	4	1	-	-	-	-
Top 25 papers	-	-	-	-	-	-
Impact factor of journals	0.357	-	-	1.728	0.2	-
Density of keywords (% of a text):						
disaster	-	-	0.94791345420312	1.7440626627824	-	1.44508262655058
artificial intelligence	0.464981756696625	0.444973230220103	0.298657663653035	0.266239654274303	-	0.155233485273987
education	0.0800925513927186	0.0214158239143392	0.0292165105747588	-	4.19497550955917	1.27009215224171

Fig. 4. User window of the Text Analytics for INCLUDE Project for the analysis of the citation index of papers (Scopus, ScienceDirect, Google Scholar), citation of authors and impact factor of journals.

6. The full document name and contents will be provided by pressing the blue sign „Search result document (PDF)“ (Fig. 4).
7. DRR datasets, multimedia, papers, thesis, webinars, material from workshops, etc., are sent to the O5 Platform administrator by e-mail (arturas.kaklauskas@vilniustech.lt). The administrator uploads these DRR datasets, multimedia, etc., to the Platform.

8. Conclusions

The Online research repository with open educational resources was developed to:

1. Encourage research among underrepresented communities (in the EU and also elsewhere) by providing access to world class DRR research through an open access repository.
2. Medium to share, showcase DRR research and educational material easily, and increase stakeholder visibility.
3. Enable and promote lifelong learning within the DRR community by strengthening research capacity.

4. A platform to share unpublished work such as datasets, dissertations, reports, case studies, multimedia content in DRR etc.
5. Maintain long-term preservation and accessibility to DRR related research outputs.

The plans for the next stage of the Online research repository with open educational resources development involves integrating this platform with other IoT, IoB, Cognitive IoT-based e-learning platforms, and learning platforms grounded on AI.

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