

Extended Reality and LBS

REPORT

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CONTENTS

Executive Summary	3
Introduction	4
Types of XR	4
Virtual Reality	4
Augmented Reality	4
Mixed Reality	4
Other Emerging XR technologies	4
A Brief History of XR	5
XR for Adult Literacy and Basic Skills (LBS)	6
XR for Workplace and Workforce Literacy	7
Benefits of using XR Training in Workforce/Workplace Training	7
XR in Corrections Literacy	8
Limitations of XR in LBS	8
Integrating XR into a Literacy and Basic Skills (LBS) Program	9
Best Practices for Integrating XR into LBS Programming	9
Popular VR and MR Headsets	10
Sample XR Tools for Education	11
A Survey of XR in LBS	14
Summary	16
Appendix A: Virtual, Augmented and Mixed Reality in LBS- Full Survey Results	17
Appendix B: Case Studies	21
Case Study #1: Come To Work Ontario North and West (CNIB)	21
Case Study #2: Realistic, Immersive Safety Education (RISE)	21
Case Study #3: CareerLabsVR	22
Appendix C: Recent XR Education Projects in Canada	24
Second Life for Border Services Officers	24
International Students Learning English Through VR and AI	24
Microsoft HoloLens Testing for Skills Trades	24
Language Instruction for Newcomers to Canada (LINC) Pilot	25
eCampusOntario VLS Collection	25
360 Interactive 3D VR Distillation Laboratory	25

EXECUTIVE SUMMARY

Extended Reality (XR), comprising virtual, augmented and mixed reality, is increasingly being adopted in education and training programs globally and is widely used in various sectors including gaming, entertainment and education. It has the potential for a wide range of applications in adult literacy, including technical training, professional development, distance learning, continuing education, soft skills training, cultural and historical education, stress-relieving, language learning, virtual field trips, and special needs training.

A survey conducted by Literacy Link South Central (LLSC) and Contact North | Contact Nord in Fall 2022 showed that although over half of the respondents were familiar with Extended Reality (XR), less than 3% had used it in adult literacy programs, suggesting an opportunity for future adoption as the technologies become more accessible.

This report identifies various ways XR can be used to support adult literacy and basic skills learners. It also outlines some of the limitations and best practices for integrating different types of XR into programming. A basic overview of popular hardware and software is included.

The report concludes with sample case studies and examples of XR projects from across Canada providing real-life examples of how XR can be integrated into programming.

INTRODUCTION

Extended Reality (XR), an umbrella term that includes virtual reality (VR), augmented reality (AR) and mixed reality (MR), is gaining popularity in education and training programs around the world. VR is a fully immersive digital experience, AR overlays digital information on the real world, and MR combines elements of both VR and AR to create a hybrid experience. These technologies are used across industries, such as gaming, entertainment and education.

TYPES OF XR

Virtual Reality

Virtual reality (VR) is a computer-generated simulation of a three-dimensional environment that can be interacted with using specialized equipment, such as a VR headset. The VR experience is anchored to the virtual world, allowing a person wearing a headset to interact with the real world while “being” in the virtual world.

The user is fully immersed in the digital environment, experiencing it as if it were real, and can interact with it using natural movements and gestures. VR is used in a variety of applications, such as gaming, education and training, as well as therapy and rehabilitation. In VR technology, the user wears a headset that covers the eyes and sometimes the ears to create an immersive experience.

Augmented Reality

Augmented reality (AR) is a technology that enhances one’s current perception of reality with the addition of computer-generated information such as sound, video, graphics or GPS data. Unlike VR, which creates a completely artificial environment, AR uses the existing environment and adds to it. AR is anchored to the real world, such as placing a virtual object on a table. It can be used for a variety of purposes, such as education, entertainment and industrial applications. The AR user can see the real world with digital information superimposed on it, either through a smartphone camera or a head-mounted display. Examples of AR tools include smartphone and tablet apps, such as Pokémon Go and IKEA Place, which use the device’s camera and GPS to overlay digital content on the real world.

Mixed Reality

Mixed reality (MR) is a term that encompasses both VR and AR to describe a spectrum of technologies that blend the real and the virtual worlds. Merging the real and virtual worlds produces new environments and visualizations where physical and digital objects co-exist and interact in real time. MR can be experienced through various devices such as head-mounted displays, smartphones, tablets and smart glasses. It has a wide range of use-cases in gaming, education, design and industry. MR is considered an evolution of AR and VR technology and has the ability to offer more immersive and interactive experiences.

OTHER EMERGING XR TECHNOLOGIES

Haptic Technology

Haptic technology, also known as kinaesthetic communication or 3D touch technology, uses tactile feedback to simulate the sense of touch and provide a more immersive experience for the user.

Haptic technology can include physical feedback, such as vibrations, or thermal feedback, such as changes in temperature, to simulate the feeling of touch.

Haptic technology is used in a wide range of applications, including virtual and augmented reality, mobile devices, video games and medical devices. In VR and AR, it can provide a more realistic and immersive experience by simulating the feeling of touching and manipulating virtual objects. In mobile devices and video games, it can provide physical feedback to the user, such as when a button is pressed or an action is performed. In medical devices, haptic technology can be used to simulate the feeling of surgical procedures or to provide feedback to doctors and patients during rehabilitation.

Overall, haptic technology is an important area of research and development that has the potential to enhance human-computer interactions and create more immersive and engaging experiences for users.

Spatial Computing

Spatial computing refers to the use of advanced technologies such as VR, AR and MR to create computer-generated content that interacts with the physical world and allows users to experience and manipulate digital information in three-dimensional space.

Spatial computing enables the seamless integration of digital information into the physical environment, allowing users to interact with virtual objects and information in a more natural way. It involves the use of sensors and other technologies to track the user's position and movement, and to create a sense of presence within the virtual environment.

Spatial computing is still in its early stages, but it has huge potential for applications in gaming, architecture and education.

A BRIEF HISTORY OF XR

The evolution of XR can be traced back to the mid-20th century when the first steps were taken toward the development of computer graphics and virtual reality.

In 1962, Morton Heilig, a cinematographer and inventor, created the Sensorama, a machine that could display stereoscopic 3D images and sound, and simulate wind and smells. This was the first example of a truly immersive experience.

In the 1970s, NASA developed a VR headset that allowed astronauts to simulate different scenarios in space. Later, in the 1990s, the term “virtual reality” became popularized with the release of consumer devices such as the Virtual Boy and the Sega VR.

The term “augmented reality” was first coined in 1992 by Tom Caudell and David Mizell, who were working at Boeing at the time. They used AR to help workers assemble and maintain aircraft more efficiently. Since then, AR has been used in a wide variety of industries, from healthcare to education to entertainment.

The term “mixed reality” was introduced in 2007 by University of Toronto researchers Paul Milgram and Fumio Kishino. They defined MR as a technology that “encompasses augmented reality, where virtual objects are superimposed over the real world, and virtual reality, where the real world is replaced by a virtual environment.” Microsoft's HoloLens is an example of an MR headset.

XR technology has advanced significantly over the years, with better hardware, software and user experiences. As technology continues to evolve, XR is likely to become even more immersive and mainstream, with the potential to revolutionize the way we interact with digital content and the world around us.

XR FOR ADULT LITERACY AND BASIC SKILLS (LBS)

XR has the potential to be a powerful tool for LBS, with immersive, interactive learning experiences that engage learners and make complex concepts more tangible and accessible. There are many sites where you can access content for free as long as you have a compatible headset, and many ways XR can be used in LBS:

- **Technical training:** XR can be used to simulate real-world work environments and tasks, allowing adult learners to practise and improve their skills in a safe, controlled setting. XR can be used to create interactive, step-by-step instructions and procedures for technical tasks, making it easier for adult learners to understand and perform complex procedures. This can be particularly useful for skilled trades training, as well as training to support manufacturing and healthcare.
- **Professional development:** XR can give adult learners the opportunity to learn about new technologies and stay up to date with the latest industry trends and best practices.
- **Distance learning:** XR can be used to connect adult learners with remote instructors and learners, providing an immersive and interactive learning experience.
- **Continuing education:** XR can be used to create interactive and engaging educational experiences, making it more interesting for adult learners to continue their education.
- **Soft skills training:** XR can simulate real-life situations for learners to practice and improve their interpersonal skills, such as communication, collaboration, leadership and problem-solving. For example, learners can participate in virtual role-play scenarios where they engage with simulated avatars, responding to their questions or dealing with challenging situations. XR simulations can provide learners with immediate feedback on their actions, and they can replay the scenarios to keep improving.
- **Cultural and historical education:** XR can be used to transport adult learners to different time periods and places, providing them with an immersive and engaging way to learn about history and culture.
- **Stress relief:** XR can be used to provide adult learners with a stress-relieving and relaxing environment, helping them unwind, reduce anxiety and improve their overall well-being.
- **Language learning:** XR can be used to create an immersive language-learning experience for adult learners, providing them with the opportunity to practise speaking, listening and comprehension skills in a realistic and engaging environment. Learners could also use XR to “visit” a foreign country and practise conversing with native speakers.
- **Field trips:** XR can allow learners to go on virtual field trips to museums and art galleries and even places that are impossible to “visit” in person such as distant planets and ancient civilizations.
- **Science and math concepts:** XR can make abstract scientific and mathematical concepts more concrete and easier to understand. For example, learners could use XR to explore the inner workings of a cell, the structure of an atom or the geometry required in the construction industry.
- **History and social studies:** XR can bring historical events and people to life, allowing learners to experience what it was like to live in a different time and place. For example, learners could visit a battlefield, meet famous historical figures or experience life in a different culture.
- **Special needs:** XR can be a useful tool for learners with special needs, as it provides a safe, controlled environment for learning and practising new skills. For example, learners with anxiety or social phobias could use XR to practise social interactions and build confidence, while learners with physical disabilities could use it to participate in physical activities that they might not be able to do in the real world.

Overall, the use of XR in adult education can offer learners an immersive and interactive experience that can be engaging, motivating and effective in facilitating the learning process.

XR FOR WORKPLACE AND WORKFORCE LITERACY

XR is a useful tool that provides immersive, interactive training and learning experiences in the workplace that can be tailored to the specific needs of a company or organization. XR can support workplace and workforce training in a many different ways:

1. **Training:** XR can be used to train employees in a variety of skills, such as customer service, safety procedures and technical tasks. The training can be tailored to the specific needs of an organization, providing a safe and controlled environment for employees to learn and practise new skills.
2. **Onboarding:** XR can be used to help new employees get up to speed quickly and effectively. XR onboarding can include virtual tours of the workplace, introductions to colleagues and key processes, and training on company policies and procedures.
3. **Collaboration:** XR can facilitate collaboration among employees, even when they are located in different parts of the world. VR meetings and workshops can allow employees to work together in a virtual environment, sharing documents and ideas in real time.
4. **Customer service:** XR can be used to provide immersive, interactive customer service experiences such as virtual product demonstrations and virtual consultations with experts in a particular field.
5. **Virtual workspaces:** XR can be used to create virtual workspaces that allow employees to work from anywhere, using VR headsets to connect to a virtual office environment. This can be especially useful for companies with remote employees or for those looking to reduce their carbon footprint.

Benefits of using XR Training in Workforce/Workplace Training

- **Enhanced safety:** By simulating real-world scenarios in a controlled environment, XR reduces the risk of accidents or injuries. This is particularly important for high-risk trades such as construction, electrical work and welding.
- **Cost-effective:** Workplace training can be expensive, especially when it involves the use of specialized equipment or machinery. XR training can help reduce these costs by simulating scenarios that would otherwise require expensive equipment or real-world experiences.
- **Realistic simulations:** XR technology can create realistic simulations that allow workers to experience scenarios that might not be possible in real life. This can help workers prepare for emergencies and complex or high-pressure situations without the risk of real-world consequences.
- **Increased efficiency:** XR training can be customized to meet the needs of individual workers, allowing them to learn at their own pace and focus on areas where they need the most improvement. This can help increase the efficiency of the training process and reduce the time it takes for workers to become proficient.
- **Remote accessibility:** XR training can be accessed remotely, which is particularly important during a pandemic or other times when in-person training is not possible. Workers can access XR training modules from anywhere, at any time, as long as they have a XR headset and a reliable Internet connection.

Overall, the use of XR in workforce or workplace training can lead to safer, more efficient and more effective training experiences, ultimately benefiting both workers and their employers.

XR in Corrections Literacy

Providing real-life task-based training in a correctional setting is challenging. The benefits of XR can be used in corrections literacy in many of the same ways it supports LBS programs:

- Vocational training: XR can be used to simulate real-world work environments and tasks, allowing inmates to practise and improve their skills in a safe, controlled setting. This can be particularly useful for fields such as construction, manufacturing and healthcare.
- Literacy and numeracy training: XR can create interactive and engaging learning experiences, making it more interesting for inmates to learn and practise their reading, writing and mathematical skills.
- Behavioural therapy: Simulating real-world scenarios gives inmates an opportunity to practise social and emotional skills.
- Language learning: XR can create immersive and interactive language-learning experiences, allowing inmates to practise their speaking, listening and comprehension skills in a realistic and engaging way.
- Job readiness: XR can be used to simulate real-world job environments and tasks, allowing inmates to gain experience and improve their skills in a safe and controlled setting.
- Distance learning: Interactive and engaging online learning experiences can allow inmates to access training and education from anywhere, even within a correctional facility.
- Rehabilitation: XR can be used to help inmates understand and overcome addictions or other behavioural issues.

These are just a few examples of how XR technology can be used in corrections literacy, but the potential uses are broad and varied. As technology continues to improve, it is likely that even more innovative and effective uses of XR in corrections literacy will continue to be developed.

LIMITATIONS OF XR IN LBS

XR applications can be a great tool in augmenting LBS programming. However, there are also limitations.

- Cost: XR technology can be expensive, and not all education institutions can afford to invest in it.
- Technical requirements: XR technology requires powerful hardware and software, which may not be available on all devices. This can limit the ability of learners and educators to access XR experiences on their own devices.
- Learning curve: Using XR technology can be challenging, especially for new users. Practitioners need to learn how to implement and/or create XR experiences effectively, which can be time-consuming.
- Limited content: There is currently a limited amount of XR content available for education. It may not cover all subjects or be suitable for all learning levels.
- Safety concerns: There are potential safety concerns when using XR technology, particularly with VR, which can cause motion sickness or eye strain. Educators need to be aware of these concerns and take steps to mitigate them.
- Distractions: XR experiences can be immersive and engaging, but they can also be distracting.

This can be a problem if learners become more focused on the technology than on the educational content.

- **Accessibility:** XR experiences may not be accessible to all learners, particularly those with disabilities or who require special accommodations. Educators need to ensure that XR experiences are inclusive and accessible to all learners.

INTEGRATING XR INTO A LITERACY AND BASIC SKILLS (LBS) PROGRAM

There are several ways to integrate XR into programming, depending on the subject matter, the goals of the learners and the resources available.

1. **Use XR as a supplement to traditional course materials:** Supplement lectures, readings and assignments, for example, with XR to provide interactive, immersive experiences that illustrate key concepts or allow hands-on practice of new skills.
2. **Incorporate XR into assignments and projects:** Incorporated XR in a way that lets learners explore and demonstrate their understanding of course material. For example, learners could create XR experiences that illustrate historical events, scientific concepts or artistic techniques.
3. **Use XR as a collaborative tool:** XR can be used to allow learners to work together in a virtual environment, even if they are located in different parts of the world. This can be especially useful for courses that involve teamwork or group projects.
4. **Offer XR as an optional component of the course:** If you are interested in integrating VR into your course but are not sure how to do so, you could consider offering XR as an optional component. This allows learners to explore XR at their own pace and can help you gauge their interest in using XR as part of the learning experience.
5. **Consider purchasing or borrowing XR equipment:** To use XR as part of your course, you will need to have access to equipment such as headsets and controllers. There are several options available, ranging from high-end systems that require a computer or console to run to low-cost options that use smartphones as the display and processor.

BEST PRACTICES FOR INTEGRATING XR INTO LBS PROGRAMMING

XR offers promising ways to engage learners and learning outcomes in adult education. And although XR in education is still in its infancy, best practices in teaching and learning are being developed to guide educators so they can provide a safe and enjoyable immersive experience.

Integrating XR into LBS programming can be an overwhelming task. Following these best practices will help:

- Consider whether adding XR to the current learning experience will add value to your program. It's exciting to add new technology, but does it support the needs of the learners?
- Keep it simple and start small. AR is a good choice because there are many free, readily available options. Augmented technology requires little initial investment in money or time. Some examples might include a virtual tour of an education institution or workplace linked to a learner's goal path.
- Pick one clear learning objective that you want to support with XR. Identifying the learning objective(s) you want to achieve and ensuring that it aligns with the learner's goals will help you choose the right type of XR experience. Once you have been successful with one objective, expand your focus.
- Use XR to enhance the learning but not replace it.

- Choose technology that is simple and easy to use. This will allow learners to focus on the content and the tasks rather than the technology itself.
- Make sure the technology is adaptive and compatible with your current programming space and technology infrastructure (e.g. Internet connectivity when streaming rich VR experiences).
- Using the same task-based approach currently used in LBS works well with the integration of XR. Make the training as realistic and engaging as possible by using real-world scenarios and inputs or materials. This will help learners apply new skills in a practical context.
- Offer a variety of different experiences to keep learners engaged. Use interactive simulations, immersive environments and gamify activities to keep learners interested and motivated in their training. Gamification is the process of using game mechanics and design elements in non-game contexts to engage and motivate people to achieve a specific goal or outcome. In the context of adult education, it can make learning more engaging and enjoyable by incorporating elements of games into the learning process, including game mechanics such as points, badges and leader boards.
- Introduce game-like challenges or quests that encourage learners to complete specific learning tasks. Gamification can be particularly effective in adult education because it helps learners stay motivated and engaged throughout the learning process. By making learning fun and engaging, gamification can help learners retain more information and apply it more effectively in real-world situations.
- Integrate collaborative features to connect learners with other learners virtually. This provides a platform to simulate teamwork and enhance the social aspect of a learning experience.
- If you are integrating XR into programming, it is important to ensure the content is accessible to all learners, including those with disabilities. Some examples include closed captions, audio descriptions and alternative control methods.
- Incorporate opportunities for feedback and assessment. It is important for learners to understand where they are progressing and where they need to improve.
- XR constantly evolves and improves so it is important to continuously evaluate the training to ensure it remains relevant and effective. Following some XR blogs or accounts can help you keep up with the constantly changing XR landscape. Some places to start:
 - RoadToV: <https://www.roadtovr.com/> Virtual reality news website.
 - Voices of VR: <https://voicesofvr.com/> Interviews with people in the VR community.
 - AR/VR Tips: <https://arvrtips.com/> Up-to-date AR and VR news site with helpful articles and links.

POPULAR VR AND MR HEADSETS

VR headsets remove vision of the real world and provide video to each eye allowing for depth of vision. This technology is then supported by head and body tracking to connect the virtual world to the user. Some headsets are standalone and allow the user to download the VR experience directly to the headset. Others require a gaming computer or other device like a smartphone or tablet to run the experience. Gaming computers typically start at \$1,000 and increase in price depending on the capabilities.

There are many different VR headsets on the market. The best one for your program will depend on your budget, the type of content you want and the devices your students already own. Below are some popular headsets on the market at the time this report was written. There are many inexpensive “off-brand” headsets available as well.

Headset	Description	Approximate Cost
<u>Google Cardboard</u>	Google Cardboard is a basic VR headset s made of cardboard that uses your smartphone as the display and processor. It is a low-cost option suitable for basic VR experiences and is easy to set up and use. Works with any smartphone.	\$20
<u>HP Reverb G2</u>	VR headset requires a gaming computer to run.	\$1,000
HTC Vive Pro 2	VR headset that requires a gaming computer to run.	\$2,000
<u>Metaquest 2 or Metaquest Pro</u>	Metaquest 2 and Pro (formerly branded as Oculus) are stand-alone VR headsets.	\$600-2,300 depending on capacity
Microsoft HoloLens 2	MR headset projects 3D holograms onto the lenses. The wearer can move around the object, manipulate it and experience it as if it were actually present. Holograms can respond to your gaze, gestures and voice commands. It is a standalone headset. Hand controls allow the wearer to manipulate the 3D projections as well. HoloLens will display 2D windows so you can use it with some traditional apps.	\$5,000+
<u>Pico Neo 3 or Pico 4</u>	Pico Neo 3 and 4 are standalone VR headsets.	\$950-1200
<u>PlayStation VR2</u>	VR headset requires a PlayStation and games.	\$800
<u>Valve Index</u>	VR headset requires a gaming computer to run.	\$1,000

Contact North | Contact Nord currently has both hardware and software options that literacy programs can borrow. For more information, please contact E-Channel@contactnorth.ca

SAMPLE XR TOOLS FOR EDUCATION

Many XR tools have been developed to support education, and new tools are being developed constantly. Some organizations have subscription-based libraries of content. They can be quite costly and are typically based on a yearly subscription model. However, they may have very industry-specific content that can be used for specific learner goals.

The table below contains a sample list of XR tools available at the time this report was written. Many are free or low-cost and are a good place to start if you are at the beginning stages of integrating XR into programming. Some tools have ready-made XR tools like simulations or 360 videos. Others support developing your own XR apps or web-based tools.

Tool	Description	Cost
Google Arts & Culture Virtual Fieldtrip https://artsandculture.google.com/project/expeditions	Art, history, geography, celebrations, virtual fieldtrips.	Free
Unimersiv https://unimersiv.com/	Unimersiv is an application available on a wide range of VR devices and platforms that provides VR educational experiences to learners and educators. Through virtual and augmented reality, learners can explore multiple topics ranging from history and space to human anatomy. The app is available for free for iOS and Android.	
CBC VR Documentary https://www.cbc.ca/radio/thecurrent/canada-s-missing-and-murdered-vr-documentary-1.4404886	CBC's first VR documentary. Watch the coverage of <i>Highway of Tears: 360 Video</i> to experience British Columbia's missing and murdered Indigenous women on YouTube , Facebook app , or Oculus app . The CBC VR app is also available on Android and iOS.	Free
Sesqui http://sesqui.ca/en/vr/	Sesqui VR offers Indigenous 360-degree experiences of Canada's arts and innovation scene. Immersive full-screen experiences include virtual storytelling, interactive games and learning resources. Six original, interactive virtual reality stories feature Canadians who are shaping their world through creativity.	Free
Youtube 360 Videos https://www.youtube.com/@360/channels	Youtube's official VR channel supports 360 video uploading and playback on mobile devices and in a browser on computers. For a more immersive experience, learners can watch videos with VR headsets. You can also search for VR content on Youtube by adding "VR" or "360" when you search.	Free
STEAM https://store.steampowered.com/	Steam is a gaming platform where you can search for free and paid VR content. You can search through the content for VR games and apps. For example: VR Anatomy https://store.steampowered.com/app/925830/VR_Anatomy/ VR Anatomy is an application designed to help students learn about human anatomy in a simplified VR environment. Explore six different interconnected systems in stunning detail with fully labelled interactive components.	Free

nearpod https://nearpod.com/	<p>Nearpod is an interactive presentation platform that allows educators to create and deliver engaging multimedia lessons to students. It offers features such as slideshows, videos, quizzes, polls, drawing tools, and includes virtual reality experiences, which can be incorporated into a single lesson.</p> <p>Nearpod is available as a web application and a mobile app, making it accessible on a range of devices. Through virtual and augmented reality, learners can explore multiple topics ranging from history and space to human anatomy. It also integrates with several learning management systems.</p> <p>The app is available for free for iOS and Android.</p>	Free and paid versions
Thinklink Education https://www.thinglink.com/	Add hotspots to images, videos, 360/VR & 3D models, and combine them into an engaging scenario. Embeddable to any website or LMS. Integrations with Microsoft, Google, Canvas, Canva & more!	Free Trial - \$60/year US
CoSpace EDU https://cospaces.io/edu/	Web-based platform where you can build your own VR simulations, tours, games, etc.	Free basic version, Pro version \$55 USD per year + \$7.50 per year per seat
Blender https://www.blender.org/	Blender is a free and open-source 3D creation software that can be used for creating 3D models, animations, visual effects, video games and more.	Free
Ikea Place https://www.ikea.com/ca/en/customer-service/mobile-apps/#f2500e9e-979b-11eb-813d-1bc9179ccd0c	IKEA Place lets you virtually place true-to-scale 3D models in your very own space and make them appear as part of your world. Combining the latest AR technology and IKEA's furniture catalogue, you can experience IKEA like never before. Test your furnishing ideas through the lens of your phone using augmented reality.	Free
Aquila Education https://www.aquilaeducation.com/	A teacher-focused site with kits to sell, lesson plans and other education technology-related content.	Paid
Aurasma http://aurasmaproject.weebly.com/	Allows users to create and share AR content, such as 3D models, videos and animations.	Free

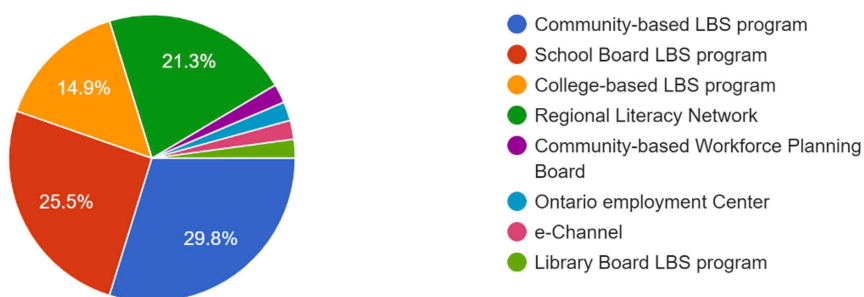
H5P https://h5p.org/	You can use H5P to create, share and reuse interactive content. Content can be published on your website or learning management system. H5P also offers a paid service to host your content online.	Free
8th Wall https://www.8thwall.com/	Allows users to develop WebAR, or web-based augmented reality, which enables augmented reality to work within a browser. Web AR opens up new ways to connect with users by engaging them in extraordinary, interactive experiences anywhere they are — all with no app required.	Paid – approximately \$150 per year
Sketchfab https://sketchfab.com/feed	Sketchfab is a web-based viewing, creating and publishing tool for 3D models. 3D models created with Sketchfab can be embedded and shared on websites, forums and social media pages	Free and paid versions

A SURVEY OF XR IN LBS

In Fall 2022, Literacy Link South Central and Contact North | Contact Nord surveyed literacy agencies across the province about their familiarity with VR, AR and MR and how it is currently being used in programming. There were 47 respondents from a range of organizations across the province.

Please indicate your organization type below:

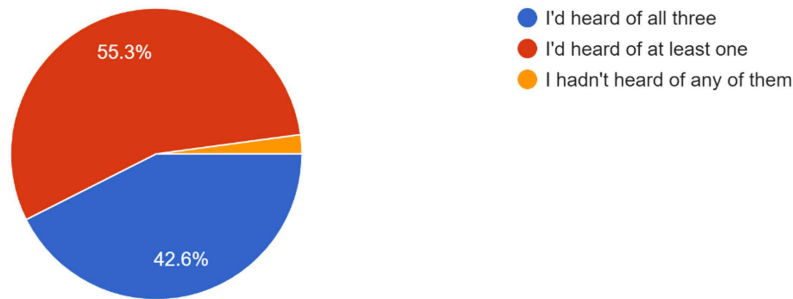
47 responses



Although more than half of respondents had used XR personally, fewer than 3% had used it with learners in an adult literacy program.

Were you familiar with Virtual Reality, Augmented Reality or Mixed Reality (VR, AR or MR) before starting today's survey?

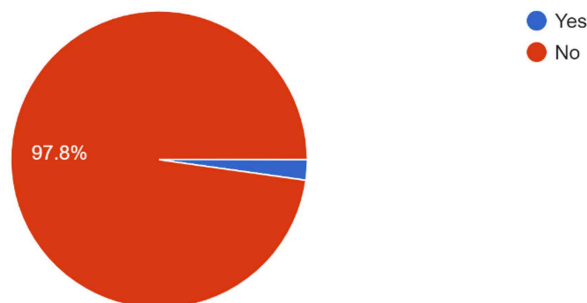
47 responses



Almost 20% of the respondents knew of another organization that had used XR with clients but less than 2% had considered partnering with organizations with access to XR tools so they could introduce them to LBS participants.

Have you talked to any other organizations in your community about partnering to offer access to VR, AR or MR training for learners in your adult literacy program?

45 responses



Based on the results, there is a significant opportunity to introduce XR tools into LBS as the technologies develop and become more accessible in the future. Full survey results have been included in Appendix A.

SUMMARY

Extended Reality (XR), which includes virtual, augmented and mixed reality, is being increasingly used worldwide in education and training programs, as well as in various sectors such as gaming, entertainment and education. The potential applications of XR in adult literacy are numerous, including technical training, professional development, distance learning, continuing education, soft skills training, cultural and historical education, stress relief, language learning, virtual field trips, and special needs training. However, a survey conducted by Literacy Link South Central (LLSC) and Contact North | Contact Nord in Fall 2022 found that although more than half of the respondents were familiar with XR, fewer than 3% had used it in adult literacy programs. Therefore, there is an opportunity for future adoption as the technology becomes more accessible.

XR technology can be a great tool for LBS programming, but it has some limitations, including cost, technical requirements, learning curve, limited content, safety concerns, distractions, and accessibility issues. Educators must be aware of these limitations and take steps to ensure XR experiences are inclusive and accessible to all learners.

There are many ways to integrate XR technology into an LBS program, including supplementing traditional course materials, incorporating it into assignments and projects, using it as a collaborative tool, and offering it as an optional component of the course. The approach taken depends on the subject matter, learner goals and available resources.

When considering implementing XR educators should consider whether XR will add value. It is important to keep it simple by starting small — for example, with AR. Identifying one clear learning objective to support with XR and using technology that is simple and adaptive is key. Using real-world scenarios and gamification will keep learners engaged and motivated.

Hardware and software options for XR are endless and are continually being updated. New technologies emerge daily. When choosing a hardware for your program, consider your budget, the type of content you want to experience, whether there are options to borrow equipment, and the devices you already own. There are many free or low-cost software options and they are a great place to start if you are at the beginning stages.

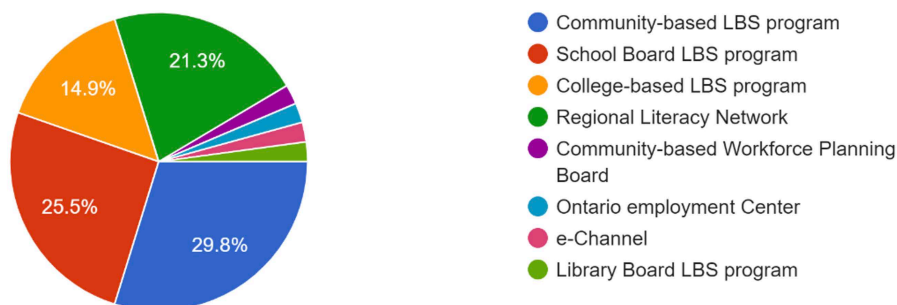
XR has the potential to transform adult education by providing innovative and immersive, experiential learning that can enhance knowledge retention, skill development, and outcomes. XR has the potential to be a great tool for literacy and basic skills. It allows for immersive, experiential learning that engages learners and enhances their understanding of concepts. With XR technologies, adult learners can explore realistic simulations of real-world environments, objects and scenarios they might not otherwise have access to. They can practise and apply new skills and knowledge in a safe, controlled environment, where mistakes can be made without real-world consequences. This can help build confidence and competence and reduce the risk of error in high-stakes situations. With XR, learners can progress at their own pace, receive immediate feedback, and revisit difficult concepts until they are fully understood.

Using XR, adult learners can have personalized and adaptive learning experiences tailored to their individual needs, preferences, and learning styles consistent with LBS program guidelines.

APPENDIX A: VIRTUAL, AUGMENTED AND MIXED REALITY IN LBS- FULL SURVEY RESULTS

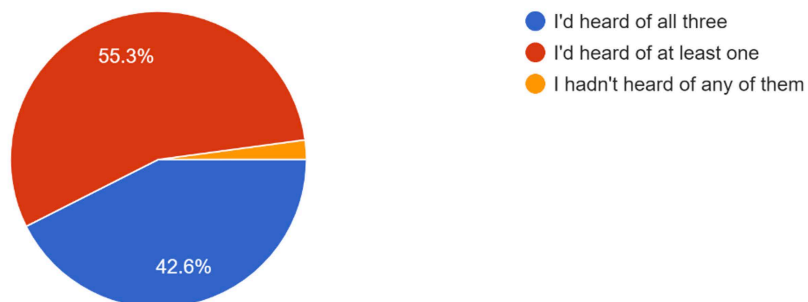
Please indicate your organization type below:

47 responses



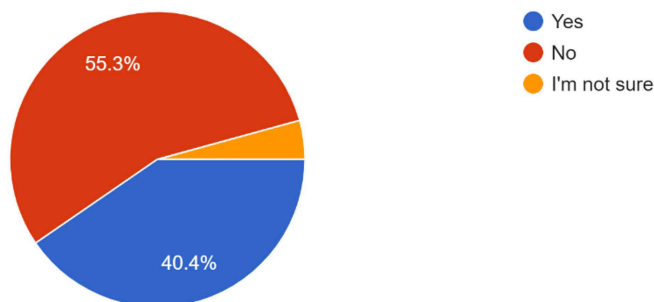
Were you familiar with Virtual Reality, Augmented Reality or Mixed Reality (VR, AR or MR) before starting today's survey?

47 responses



Have you used VR, AR or MR personally (outside your adult literacy program)?

47 responses



If you answered yes, please share what you've used / experienced.

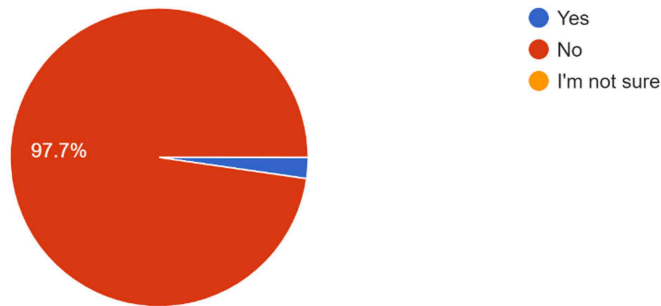
- I've used AR in places like the AGO, where you can use their app to have art pieces "come to live" and tell you about themselves. I've also used an app that makes beverage labels tell you about

the drink inside the bottle, or the history of the company that makes them. In terms of VR, I've only had opportunities to try it occasionally, but recall using a VR headset to explore architecture as part of a virtual tour put on by a historical society.

- I have tested some equipment prior to the Pandemic and then had recently been participating in the Mobile Hub and had the opportunity to test some equipment which is available through the Smart Life CNIB store such as the OrCam the CNIB Foundation also has a VR room available for use at the London downtown location but I have not had the chance to check it out yet as they have recently reopened their office. Apple iOS 16 will be bringing some amazing upgrades in this area: <https://www.apple.com/ca/newsroom/2022/05/apple-previews-innovative-accessibility-features/> We hope to test them with DB learners when available.
- Eye Buy Direct - you can virtually try on glasses.
- My grandson uses it, and I was able to work in a store using VR
- Virtual Reality
- VR - gaming
- I have used AR and VR only on an introductory level
- 3D-Google Maps, CAD Software - ACAD, Catia, Solidworks, Disney World Orlando
- VR: Google Earth & Google VR goggles. VR Golf / AR: galleries audio enhanced tours telling stories of artists and sometimes reading letters that they wrote to add engagement to visual art. Also, Google Lens if that counts...it allows the use of a camera to search the internet for similar images and allows the user to learn more about them; it's good for plant/animal identification / MR: no experience
- VR to explore training opportunities
- I used a VR set called Oculus. It was an assimilated roller coaster ride at Canada's Wonderland.
- VR
- Just a game on a friends set
- PlayStation VR, Apps, Pokémon Go
- I've use VR, AR and MR. MR was used in my accessibility training to simulate visual disabilities and VR/AR I've used for games. Also used AR for star maps. In my experience AR and MR are easier to use as sometimes VR can be overwhelming.
- AR
- Games
- I used VR goggles in an accessibility seminar

Have you used VR, AR or MR with learners in your adult literacy program?

44 responses

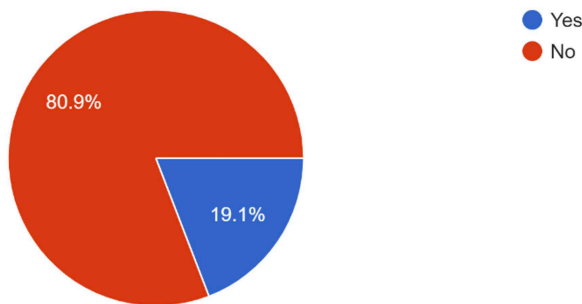


If you answered yes, please share what you've used / experienced.

- We've used AR apps to help LBS learners at programs in our area explore educational opportunities, and to help them get past a fear of technology.

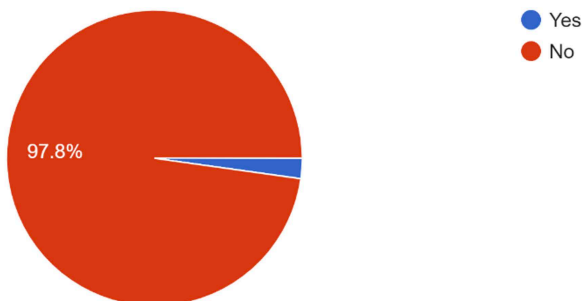
Are you aware of other organizations in your community (ex. Employment Services, Apprenticeship Training Delivery Agents) that use VR, AR or MR with their clients?

47 responses



Have you talked to any other organizations in your community about partnering to offer access to VR, AR or MR training for learners in your adult literacy program?

45 responses



If you answered yes, please tell us a bit about these conversations and potential partnership(s).

- I selected no, however a long time ago I think ATN facilitated an intro workshop with a demo

regarding VR technology. I am not positive about this.

- In one of our project proposals we had a conversation with Cupixel's CEO and he gave us a tour of how VR works. But we didn't include that in our proposal as our needs were very basic for digital technology.
- Talked with 3 employment services organizations about partnership ideas but it is early days. Mentioned our willingness in partnering at LSPs.

APPENDIX B: CASE STUDIES

CASE STUDY #1: COME TO WORK ONTARIO NORTH AND WEST (CNIB)

<https://www.cnib.ca/en/programs-and-services/work/im-looking-work-come-work/about-come-work?region=on>

Interviewee: Ryan Hooey, Program Lead

Interviewer: Summer Burton

May 19, 2022

What is Come to Work?

The CNIB Foundation's Come to Work program aims to connect job seekers with employers to enhance participation in the world of work, offering job-readiness workshops and technology training, partnering with employers to create work opportunities, providing mentorships, and enhancing company culture to provide a competitive edge. As part of their Come To Work service, CNIB is testing VR hardware and software in Ottawa, Toronto and London.

Content of the Program

The VR being used can do many things, but the focus for this project mock interviews. The technology can simulate 6 possible interview styles, including a café chat, panel interview and group interview. The technology reads the users facial expressions and body language, in addition to the responses to interview questions.

The same technology can allow someone sighted to simulate walking as a visually impaired person between the Toronto Hub and subway. This can be used as an advocacy tool.

CASE STUDY #2: REALISTIC, IMMERSIVE SAFETY EDUCATION (RISE)

hintonscaffold.com/rise

Interviewee: Erin McInnes of Hinton Scaffold Solutions

Interviewer: Summer Burton

April-June 2022

What is Rise?

Rise is a virtual reality program which stands for Realistic, Immersive Safety Education.

Their goal is to provide this 'construction safety and hazard awareness' training to people who are considering or actively pursuing employment in the construction industry.

Content of the Program

It's not skilled trades specific training, but it's focused on ensuring that any new workers to construction are starting out with a good foundation of safety principles and practices, e.g.

- an awareness of their right to a safe workplace,
- typical hazards to watch out for,
- what safety protocols their future employer should be expected to have in place.
- The program takes roughly 2 hours to complete, but with breaks and getting used to the VR technology, it takes a user closer to 4 hours (they're delivering the training as a half-day experience).

Accessing RISE

Although they're located in BC, this project was funded in part by the Ontario Ministry of Labour, Training and Skills Development through a Skills Development Fund, so they originally offered the program at no cost to schools, employment/training centres and construction industry employers/associations. However, this ended as of December 31, 2023. You can contact them directly for information on how to access this currently.

They are currently in discussions with a few major Ontario/Canadian construction firms to see if they'll officially recognize the training's certificate of completion, but that's still in progress.

The program is delivered via virtual reality, with a desktop version also available for anyone who gets queasy in virtual reality.

The two main options are:

1. "self-service" RISE training, where they send out 1-2 VR kits for anywhere from a few days to two weeks, and the organization runs people through at their own pace or
2. they can co-host a training event over 1-2 days where they bring out several VR kits and provide a facilitator to lead 5 to 10 people through the program at the same time.

CASE STUDY #3: CAREERLABSVR

<https://careerlabsvr.com/>

Interviewee: Elisabeth Meyer from the Employment + Education Centre in Brockville

Interviewer: Summer Burton

June 14, 2022

What is CareerLabsVR?

CareerLabsVR is a subscriber system that is used by educational institutions to assist with learning, a tool for industry leaders to allow job seekers to gain insight into careers, in addition to being utilized by employment agencies. VR career experiences or simulations have been developed across several different industries with a focus on skilled trades. An overview of CareerLabsVR can be viewed at

<https://youtu.be/aVctIzOreK8>

CareerLabsVR was launched via several Ontario Labour Market Partnership (OLMP) projects hosted at their Employment Ontario ES agency. They had noticed their clients had a lack of information about and access to some jobs (within the skilled trades in particular).

Content of the Simulations

They partnered with a company called UP360 and created 6 simulations, starting with a heavy equipment operator simulation. Then, they worked with the ministry to develop another 10 careers (many connected to the mining industry). They were funded for a second OLMP to develop 5 simulations based in the trades and 5 based in agriculture. At the time this report was written they had launched 26 different simulations. Through additional partnerships they plan to develop at least five more careers. They've started working with other provincial funders such as New Brunswick.

How Simulations are Developed

They work with industry experts to develop the content of the simulations, including 3 to 5 different tasks that would be common in that career (ex. In the pipefitter simulation the user looks at and interprets blueprints, measures and then cuts lengths of pipe based on the blueprint, lays that cut pipe, and communicates with their team about what they've done and what should happen next).

The Business Model

During this process the company they worked with originally (UP360) decided to go in another direction and they actually ended up buying it – now they are the company and are sourcing VR developers as needed. It's a growing field so they aren't hard to find, surprisingly. They use only Canadian developers (but not necessarily local – the developers they use come from several different provinces). Visit their website at <https://up360.co/> As a result of purchasing and running UP360, this is now considered a social enterprise. They sell a yearly subscription service that provides access to all the simulations available as well as all the supporting documents and activities.

Accessing CareerLabsVR

The yearly subscription costs approximately \$4,800 and doesn't include the actual hardware - you need a workstation that includes a gaming laptop and a VR headset (e.g. gaming laptop approx. \$1,000 and Oculus VR headset approx. \$500). The subscription fee allows them to maintain their current products and invest in more development. If you purchase a subscription, you can use it on a maximum of three workstations. There is no limit to the number of actual times you use it on those workstations, or number of participants who access simulations. They use "Clean Box," <https://cleanboxtech.com/>) a produce which uses UV technology to clean the headset between uses.

CareerLabsVR Subscriber Resources

In addition to the VR experiences or simulations subscribers also have access to the following resources:

- Implementation Tools: Online modules with best practices and how to introduce VR into your organization
- Experience Guides: Simulation guides for facilitators to help support users
- Community of Practice: Themed meetings with other subscribers to learn and ask questions
- Career Fact Sheets: Information about career experiences in the library

They have also worked with subscriber organizations to create lesson plans based on the simulations.

Several different types of organizations across North America are currently using CareerLabsVR. Some examples include:

- correctional facilities
- industry representatives (for recruitment)
- high schools and colleges

They have worked with an organization serving people with developmental delay or dual diagnosis and developed a simulation focused on Customer Service called "Careers Café". In the simulation the participant is behind a counter taking orders (from anywhere between 1 and 6 customers depending on the situation), deciding the order in which to do things, charging and making change, etc. To see more about this: https://youtu.be/wfD6t_-tcR8

APPENDIX C: RECENT XR EDUCATION PROJECTS IN CANADA

Second Life for Border Services Officers

Loyalist College

<https://teachonline.ca/pockets-innovation/border-simulation>

Loyalist College used Second Life to create a border crossing simulation for their students. The purpose was to train students on interview techniques used by Canadian Border Services Officers. The Virtual World Design Centre at Loyalist collaborated with faculty, instructional designers, 3-D designers, and builders to develop the simulation over a three-month period. The simulation is integrated into class time, with each student taking on the role of a Border Services Officer and conducting interviews with avatars of travellers who wish to enter Canada. All communication is done through voice communications within Second Life, with the players representing the travellers in a separate room from the students.

Second Life is a digital world made by Linden Lab that lets users make avatars and interact with each other in a 3D space. It's a popular social platform where people can do many things, like exploring, socializing, attending events, creating, and selling things, and even dating. Users can personalize their avatars with body shape, clothing, and accessories. They can also make their own virtual spaces called "islands" where they can have events, hang out with friends, and sell things or services. Second Life is called a "metaverse," which means it's a virtual world where people can interact in real-time. Second Life has been used for different things, like teaching, training, and advertising.

<http://secondlife.com>

International Students Learning English Through VR and AI

Simon Fraser University (Continuing Studies)

<https://www.sfu.ca/continuing-studies/about/news/2019/elc-virtro-virtual-reality-learning-english.html>

This project used virtual reality to improve literacy skills in adult learners. It allows learners to practice reading, writing, and other literacy skills in immersive and interactive virtual environments. Virtro's language-learning app was deployed to allow students to play detective in the virtual world of a cruise ship in outer space. To solve the game's central mystery, they question AI characters on the ship, practising their speaking and listening skills in the process.

Microsoft HoloLens Testing for Skills Trades

Mohawk College

<https://www.macleans.ca/education/college/augmented-virtual-reality-colleges-technology-learning/>

Mohawk is at the forefront of using Microsoft's HoloLens as an assistive tool for both in-classroom and online learning. Skilled-trade instructors have tested the device, which allows students to enter a virtual three-dimensional environment and interact with rich digital content, such as a simulated water pressure system, while remaining aware of their surroundings. Virtual reality completely immerses students in an activity, shutting out the real world. Rather than having a physical piece of equipment in front of them, students see a simulation, like a movie, through their glasses or headset.

Language Instruction for Newcomers to Canada (LINC) Pilot

Syrian Canadian Foundation and University of Toronto

<https://www.cbc.ca/radio/thecurrent/vr-newcomers-learn-english-1.6675649>

This three-year pilot was funded by the Ministry of Immigration, Refugees and Citizenship Canada runs until March 2024. It uses simulated environments to help newcomers to Canada become familiar and confident with English terms and phrases in real-life situations such as job interviews, grocery stores, and banks, and provides practical knowledge about CV and resume writing, bank account opening, and credit card usage.

eCampusOntario VLS Collection

<https://openlibrary-repo.ecampusontario.ca/xmlui/handle/123456789/1004>

The Virtual Learning Strategy (VLS) Collection is the result of an historic investment by the Ontario Ministry of Colleges and Universities (MCU) intended to drive growth and advancement in virtual learning across the province's postsecondary institutions. This collection provides eligible Ontario educators and learners with access to free high-quality online educational resources that support hybrid learning, while enabling pathways toward flexible lifelong learning and supporting system wide collaboration by expanding access for Ontario's institutions to the global marketplace for virtual learning. The collection includes many pre-made XR content packages that you can access online or download and upload to your learning management system. The VLS collection is available to eligible Ontario educators and learners either through the Ontario Commons Licenses or worldwide access through an open license (e.g., Creative Commons license). Learn more about the Ontario Commons Licenses here: <https://www.ecampusontario.ca/licensing/>

360 Interactive 3D VR Distillation Laboratory

University of Waterloo

<https://chemengvr-demo.cel.uwaterloo.ca/index.html>

This website was created through eCampusOntario's VLS strategy and funding from the Government of Ontario. This website is designed to support engineering students for deep laboratory learning of chemical engineering concepts by integrating an interactive 360° virtual reality (VR) tour of a modern pilot distillation plant with high-fidelity process simulation and multimedia. The resource is suitable for teaching and learning at all academic levels, and more effective for use in a collaborative learning setting and/or in conjunction with a physical distillation laboratory.

These are just a few examples of Canadian XR projects in Canada. It's a growing field and new projects are being developed and funded all the time.