AN INTRODUCTION TO AUGMENTED REALITY

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AN INTRODUCTION TO AUGMENTED REALITY

A Toolkit for Augmented Reality (AR)

By Sarah Canon and Ann Hill Duin, Ph.D.

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The purpose of this document is to:
1. provide a brief background to augmented realities (AR),
2. explain our research,
3. share research results, and
4. provide step-by-step instructions for beginners to create augmented reality experiences.

Here, we include instructions for three such tools: Blippar, ZapWorks, and ARIS. We are curious as to which of these (or other) applications students might best use in developing “simple” AR for an assignment or exercise in their Writing Studies courses. This toolkit aims to provide assistance in working with and creating simple AR experiences.

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INTRODUCTION

The purpose of this document is to:

1. provide a brief background to augmented realities (AR),
2. explain our research,
3. share research results, and
4. provide step-by-step instructions for beginners to create augmented reality experiences.

These instructions are intended for use by instructors and students.

While many tools exist for the creation of AR, we include instructions for three such “free” tools, ZapWorks, Blippar, and ARIS. Each of these is an easy-to-learn tool, allowing students to add a layer of interactivity to printed materials; e.g., an academic paper, poster, technical report, or a presentation. We are curious as to which of these (or other) AR applications students might best use for developing “simple” AR for an assignment or exercise in their Writing Studies courses. We are also interested in how student development of AR impacts their understanding of coursework as well as preparation for future professional practice.

Augmented Reality integrates digital information with a user’s environment in real time. Combining virtual components with human sensory modalities (i.e., sight, sound, touch, taste, and smell), the goal is to augment the reality of the person experiencing the digital information. Merriam Webster’s Dictionary defines AR as “an enhanced version of reality created by the use of technology to overlay digital information on an image of something being viewed through a device (such as a smartphone camera).” If you have used Pokemon Go, you are familiar with how AR works. When you aim your smartphone camera at your
surroundings, images pop into view, waiting for you to interact with them while in the real-world landscape.

AR technologies provide new writing and design spaces, and significant AR work is underway in a variety of industries including manufacturing, medical environments, and agriculture. For instance, AGCO, a Minnesota manufacturer of agricultural machinery and equipment is using the latest version of Google Glass on the manufacturing floor to help workers access complex diagrams, user manuals, and other documentation while working. Additional AR deployments can be viewed at the Fabric of Digital Life, a research archive at the University of Ontario Institute of Technology in Canada. AR is also being used to bring education to life as students interact more deeply with surrounding environments.

Please use the following instructions to develop AR for use in your academic or professional work. We hope that you will share your Image Target/Marker with us so that we might learn more about how instructors and students envision and use AR.

Please share your creations, comments, questions, or concerns with us:

Twitter @WRCollab_UMN
Facebook @wrcollab.

Visit our website at wrcollab.umn.edu to learn more about current and upcoming WRC projects.

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SECTION 1:
AR TOOL OVERVIEW
This is organized according to ease of use, with easier tools listed first.

ZAPWORKS
ZapWorks (a quick editor)

- **Supports**: Android and iOS.
- **Programming?** None for widgets or designer, but studio does require code.
- **Price**: Free 30 day trial; five free creations with personal license.
- **Features**:
  - Target image tracking, target codes;
  - Offers widgets, additional design tools, and an SDK option;
  - Drag and drop option;
  - Create 2D and 3D objects in Studio.
- **Capabilities**: Allows simple or complex AR creation.
- **Limitations**: Widgets is incredible simple and only allows for select content to be uploaded. Studio requires code to create.

BLIPPAR
Blippar (a quick editor)

- **Supports**: Android and iOS.
- **Programming?** None (for more complex AR creations, use Blippbuilder Script, which requires JavaScript).
- **Price**: Free.
- **Features**:
  - Drag and drop interface;
  - Target image tracking;
Has widget options;

- **Capabilities:** Allows simple or complex AR creation.
- **Limitations:** Must go through an approval process, takes 2-3 business days.

**ARIS**

*ARIS (a quick editor)*

- **Supports:** Android and iOS.
- **Programming?** None.
- **Price:** Free.
- **Features:**
  - Player location (GPS);
  - QR codes;
  - Bluetooth beacons (iBeacons);
  - Image Recognition;
  - Augmented Reality;
  - Navigation of the on-screen map;
  - Alphanumeric codes;
  - Media collection;
  - Social interaction around media collection.

- **Capabilities:** Allows for simple or complex AR creation: designed to create Mobile Games, Interactive Stories, Scavenger Hunts, Tours and Data Collection Activities.
- **Limitations:** Must connect to a database to upload content.

**AUGMANIA**

*Augmania (a quick editor)*

- **Supports:** Any browser and any device – no apps.
- **Programming?** None
- **Price:** Free 30-day trial.
- **Features:**
  - Creation of multiple campaigns;
Image markers;
Simple AR overlays.

**Capabilities:** Can be directly embedded into any social channel; does not require a specific app.

**Limitations:** Designed more for digital marketing purposes; really only published on social media platforms.

## WAKINGAPP

WakingApp (a quick editor)

- **Supports:** iOS, Android, Google Cardboard & Glass, Samsung Gear VR, Epson, Vuzix, HTC Vive and Oculus Rift.
- **Programming?** None.
- **Price:** Free for non-commercial use.
- **Features:**
  - Drag and drop interface;
  - Create, distribute and view interactive AR, 3D and VR content with no coding skills;
  - Uses ENTiT platform.
- **Capabilities:** Uses ENTiT platform to create AR experiences without code.
- **Limitations:** Results are known to be severely limited and the process a little bumpy. Requires downloading ENTiT desktop application to create AR experiences. Free version is for creating “white label” applications, branded by WakingApp.

## WIKITUDE STUDIO

Wikitude Studio (a quick editor), Wikitude (an SDK),

- **Supports:** Android, iOS, Smart Glasses, Epson moverio, Vuzix M-100, ODG R-7, PhoneGap, Titanium, Xamarin and Unity.
- **Programming?** Studio does not require code; SDK version requires Java and C++.
- **Price:** Free and commercial licenses; projects can only be published with a monthly fee.
- **Features:**
  - 3D tracking technology (SLAM);
• Image recognition and tracking;
• Geo-location AR for apps (**LLA Marker**);
• Full customization for AR view;
• Texts, images, animated images, videos, HTML widgets, sound;
• Markerless AR with Wikitude, Unity, and SLAM technology.

**Capabilities:** View tutorial page. Allows augmentation of both images and objects, it enables easy publishing in the Wikitude App as well as hosting in the sample app, and many other features.

**Limitations:** Free version comes with a watermark.
SDK: SOFTWARE DEVELOPMENT KITS

ADVANCED CREATION

VUFORIA

Vuforia is one of the most famous software development kits (SDK) for AR development.

- **Supports:** Android, UWP, Unity Editor and iOS.
- **Price:** Free and commercial licenses. The free version has limitations in cloud recognition and puts Vuforia watermark on the end product. From $99/month+ for other licenses.
- **Features:**
  - Real object, text, environments and image recognition;
  - Target image tracking;
  - Mapping additional items with OpenGL (renders 2D and 3D objects);
  - Scanning objects for recognition;
  - Virtual buttons.
- **Capabilities:** Includes support of virtual reality devices and a test app with comments showing Vuforia capabilities.
- **Limitations:** Lacks a complete manual with instructions. User must know code languages to create.

KUDAN AR

Kudan AR (an SDK)

- **Supports:** Android, iOS, and Unity.
- **Programming?** Yes: C and C++.
- **Price:** Free and commercial licenses.
Features:
- Image recognition;
- Markerless tracking (relies on the use of natural features like edges, corners, or textures);
- Designed to perceive surroundings (more for artificial intelligence).

Capabilities: Unlimited number of recognizing images.

Limitations: Insufficient development documentation and no direct access to OpenGL (Open Graphics Library), an application programming interface for rendering 2D and 3D vector graphics.

WIKITUDE

Wikitude (an SDK), Wikitude Studio (a quick editor)

- Supports: Android, iOS, Smart Glasses, Epson moverio, Vuzix M-100, ODG R-7, PhoneGap, Titanium, Xamarin and Unity.

- Programming? SDK Yes: Java and C++; Studio does not require code.

- Price: Free and commercial licenses. Projects can only be published with a monthly fee.

- Features:
  - 3D tracking technology (SLAM);
  - Image recognition and tracking;
  - Geo-location AR for apps (LLA Marker);
  - Full customization for AR view;
  - Texts, images, animated images, videos, HTML widgets, sound.

- Capabilities: The Wikitude SDK allows developers to choose between using Native API, JavaScript API or other supported extensions and plugins such as Cordova, Titanium, Unity, Xamarin and even Adobe Air and Ionic 2. View examples of creations at https://www.wikitude.com/blog-top-ar-tutorials/.

- Limitations: Free version comes with a watermark.
SECTION 2:

AR TOOL INSTRUCTIONS
GLOSSARY OF COMMON AR TERMS

Assets
The content for your AR creation (may include images, graphics, text, video, contact information, website links, and more)

Overlay
An image or graphic superimposed over an Image Target/Marker

Image Target/Marker (AKA: trackable, trigger, or AR target)
The image recognized by the App, which launches the AR experience. Images with high contrast and unique features with sharp edges are key pillars in supporting image recognition

Markerless AR
Augmented Reality that does not need any pre-knowledge of a user’s environment or image tracker to overlay 3D content into a scene and hold it to a fixed point in space. Markerless AR is often related to geo-location.

ZapCode
ZapWorks’ version of a QR code
ZapWorks has three content creation tools – WIDGETS (beginner), DESIGNER (intermediate), and STUDIO (advanced).

These let you create and bring to life just about any kind of Augmented Reality experience using unique digital tags called ZapCodes. We recommend beginning with the WIDGETS tool. Preview videos for each creation tool here.

You will need:

› A smartphone

› A desktop computer

› Digital assets/content for your creation

Ready
Download Zappar for free from your app store

Aim
Scan the zapcode then aim at the whole image

Zap
Watch it come to life!
ZAPWORKS WIDGETS
LEVEL: BEGINNER

ZapWorks Widgets creates an auto-generated layout for your content using a ZapCode.

GETTING STARTED
1. On your smartphone, download the Zappar app.
2. Using a desktop computer, visit https://zap.works/ and select ‘Start your free 30 day trial today.’ Sign up for the Personal account.
3. After confirming your account via email, you will be directed to an introductory video. Once the video is complete, your screen will become your home dashboard. To start your project, select the orange ‘Make a new ZapCode’ button.
4. Name your ZapCode, select your style, then click ‘Continue.’
5. For purposes of simplicity, select ‘Widgets’ as the tool you would like to use. It is recommended for beginners.
6. Your ZapCode project will now be added to your dashboard.

EDIT YOUR ZAP
1. In your dashboard, find the project you want to work on and select ‘Click to edit.’
2. Click ‘Edit ZapCode Content.’
3. Select a type of content from the menu on the right and upload your desired content.
4. Your content will be auto-generated into your ZapCode as an interactive item via the widget setting.
5. Your progress will automatically be saved.
6. **TIP: Add your own music!** While in editing mode, scroll to the bottom of the widget options. In the section labeled ‘Background Sound’ (see image to the right), upload your own music to automatically be played when your code is zapped.

**TESTING & PUBLISHING YOUR ZAP**

1. Select the ‘Preview’ button on the right side of the page. ZapWorks will generate a temporary unique ZapCode to preview your unpublished content.

2. Using the Zappar app on your smartphone, hover your phone camera over the ZapCode icon. Your content will appear on your phone to flip through as desired.

3. Once satisfied with your project, return to your desktop browser and select ‘Publish.’ Download, print, and place your ZapCode wherever you would like so others can access your content with ease!

**ZAPWORKS ADDITIONAL SUPPORT**

Visit [Widget Introduction](#) or [How ZapCodes Work](#).

To explore instruction for other creation tools, such as Designer and Studio, visit the [Documentation](#) page. You can also check out the [ZapWorks Forum](#), a handy way to ask questions of other ZapWorks users, or contact [support@zappar.com](mailto:support@zappar.com).
ZapWorks Designer gives you complete control over how your content is displayed and allows you to stick your content to an image of your choice.

**GETTING STARTED**

1. On your smartphone, download the Zappar app.

2. Using a desktop computer, visit https://zap.works/ and select ‘Start your free 30 day trial today.’ Sign up for the Personal account.

3. After confirming your account via email, you will be directed to an introductory video. Once the video is complete, your screen will become your home dashboard. To start your project, select the orange ‘Make a new ZapCode’ button.

4. Name your ZapCode, select your style, then click ‘Continue.’

5. Select ‘Designer’ as the tool you would like to use.

6. Your ZapCode project will now be added to your dashboard.

**EDIT YOUR ZAP**

1. In your dashboard, find the project you want to work on and select ‘Click to edit.’

2. Click ‘Edit ZapCode Content.’

3. After viewing the introductory video, select ‘Download your ZapCode.’

4. Select your desired design offered in the panel and click ‘Download PNG’ or ‘Download SVG’ in the right bar. You will now be able to add your ZapCode to your tracking image.

5. Click ‘Continue.’

6. Minimize your browser window and locate your tracking image.
7. Open your tracking image in a photo editing app of your choice and add your downloaded ZapCode to a corner of the image. Save your new image.

8. Open your browser again to return to the ZapWorks editing process page and select ‘Upload tracking image.’

9. Select and open your tracking image with your ZapCode included.

10. Click ‘Use this tracking image.’

11. You will now see the editing page. Using the right toolbar, layer your content to your desire.

12. Explore a little! Add scenes, get creative, and make a unique augmented world!

13. Your progress will automatically be saved.

**TESTING & PUBLISHING YOUR ZAP**

1. Select the ‘Preview’ button on the right side of the page. ZapWorks will generate a temporary unique ZapCode to preview your unpublished content.

2. Using the Zappar app on your smartphone, hover your phone camera over the ZapCode icon. Your content will appear on your phone to flip through as desired.

3. Once satisfied with your project, return to your desktop browser and select ‘Publish.’ Print and place your image with the ZapCode wherever you would like so others can access your content with ease!

**ZAPWORKS ADDITIONAL SUPPORT**

Visit [Designer Introduction](#) or How ZapCodes Work.

To explore instruction for other creation tools, such as Widget and Studio, visit the [Documentation](#) page.

You can also check out the [ZapWorks Forum](#), a handy way to ask questions of other ZapWorks users, or contact support@zappar.com.
ZAPWORKS STUDIO
LEVEL: ADVANCED

Use ZapWorks Studio to create more sophisticated, interactive short-form 3D experiences with a greater range of content and customization.

GETTING STARTED

1. On your smartphone, download the Zappar app.

2. Using a desktop computer, visit https://zap.works/ and select ‘Start your free 30 day trial today.’ Sign up for the Personal account.

3. After confirming your account via email, you will be directed to an introductory video. Once the video is complete, your screen will become your home dashboard. To start your project, select the orange ‘Make a new ZapCode’ button.

4. Name your ZapCode, select your style, then click ‘Continue.’

5. Select ‘Studio’ as the tool you would like to use. It is recommended for beginners.

6. Your ZapCode project will now be added to your dashboard.

7. In your dashboard, find the project you want to work on and select ‘Click to edit.’

8. You will be prompted to download Zapworks Studio (https://my.zap.works/studio/). Follow the on-screen instructions to download ZapWorks Studio to your computer.

KEY TERMS FOR ZAPWORKS STUDIO

The Hierarchy: located on the left panel of ZapWorks Studio, the Hierarchy is a tree of all the things that make up our experience. It consists of nodes (or branches), including but not limited to 3D objects, groups, scripts, sounds and videos.

Properties: located below the Hierarchy Panel on the left-hand side, Properties is where you change the attributes for the currently selected node in the Hierarchy.
The 3D View: located in the center panel of ZapWorks Studio. Your content will appear here but it’s empty when you start a new project.

The Media Library: located on the right panel of ZapWorks Studio. It’s a toolbox that contains all of the source files that we can use in our Hierarchy and contains things like images, 3D models, sound files, etc.

The Plane: a 3D object that’s square and flat and is generally used for displaying images in an experience or for defining areas that users can tap on or interact with. Add a new plane into the Hierarchy by dragging it from the Media Library to create 3D views.

Scripts: coded in a special form of JavaScript called TypeScript, Scripts build interactivity and complex state into experiences. Learn the language here.

ZAPWORKS STUDIO SOFTWARE

1. Once ZapWorks Studio has completed installation, open the ZapWorks application on your computer.

2. On the welcome screen, select ‘New Project’ and type in a project name. For the purposes of software exploration, select the ‘Blank’ template.

3. Click ‘Create.’

4. Import your content into the Media Library on the right by clicking and dragging or selecting the ‘+’ button to the right and choosing ‘Import media files.’

5. Above your media files, you will see a paper airplane icon with the word ‘Plane’ next to it. Select the icon, and holding your mouse down, drag it over to the word ‘Root’ in the upper left-hand corner of the Hierarchy panel. This will create your first set of dimensions. Settings for this plane may be altered in the Properties panel.

6. To import your content (i.e. an image) into your plane, go to the Properties panel and select the drop-down menu for ‘Materials.’ Select your desired content and it will appear on the plane.

7. To add interactivity, right-click on the ‘Plane’ icon you placed under ‘Root’ in step five.

8. Select ‘New>Script>Pointerdown.’ Pointerdown specifies an action taken when the user touches the image on their touchscreen device.
9. This will open a window to insert your own code. See ZapWorks coding resources below.

   The scripting language is powerful and expressive and, while it’s possible to create interactive experiences with only a basic understanding, the following pages give a more complete grasp of the toolset.

   ‣ View the Scripting page to view some code options.

   ‣ The General Principles page is a more in-depth introduction to the scripting capabilities of ZapWorks Studio.

   ‣ The Table of Contents hosts the reference documentation for the Z variable and its constituent functions and classes, including Utility Functions.

10. Continue adding code until you are satisfied.

11. Return to the 3D view by selecting one of the nodes in the Hierarchy, such as ‘Root.’

**TESTING & PUBLISHING YOUR ZAP**

1. To preview your work, select ‘Preview’ at the top left corner of the window (located above the Hierarchy panel). You may be promoted to log into your Zappar account; please log in. It may take a few minutes for ZapWorks to upload the content to the server.

2. Once the temporary code becomes available on your computer screen, use the Zappar app on your smartphone to hover the camera over the temporary ZapCode. After exploring your creation, exit the popup box.

3. When satisfied with your product, select ‘Publish’ from the top left corner of the window (located above the Hierarchy panel).

4. In the Publish Project box, select your account.

5. Select the project you created in Getting Started from the first part of these instructions and click ‘Choose Selected.’

6. Click ‘Publish.’

7. Once the publishing process is complete, return to your ZapWorks dashboard in your browser.
8. Select your studio project. In the center of the screen, beneath your assigned ZapCode, select ‘Download ZapCode.’

9. Download, print, and place your ZapCode wherever you would like so others can access your content with ease!

10. These are basic skills to get you started using ZapWorks Studio, but the program offers so much more. Enjoy experimenting and exploring the world of Augmented Realities using ZapWorks Studio!

**ZAPWORKS ADDITIONAL SUPPORT**

Visit [Studio Introduction](#) or [How ZapCodes Work](#).

To explore instruction for other creation tools, such as Designer and Widget, visit the [Documentation](#) page.

You can also check out the [ZapWorks Forum](#), a handy way to ask questions of other ZapWorks users, or contact [support@zappar.com](mailto:support@zappar.com).
Blippar is an easy-to-learn AR tool, allowing users to add a layer of interactivity to printed materials; e.g., an academic paper, a poster, or a presentation. Bring it to life with animations, games or 3D models. Add links to buy, collect user feedback, showcase how to use a product, share information, and more.

**Note: This tool follows a publishing process that may take 2-3 days to confirm. Once you complete your Blipp, the company must approve it before its use.**

You will need:

- A smartphone
- A desktop computer
- Digital assets/content for your creation

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**Step One**

Download Blippar App

**Step Two**

Fill screen with image

**Step Three**

Blipp Image into life
CREATING A NEW BLIPP
Before you begin, be sure to collect all of your assets, such as pictures, videos, and facts.

1. Go to https://web.blippar.com/blipp-builder and click ‘sign up’ (or ‘sign in’ if you already have an account).

2. From your account homepage, click on ‘+New Campaign’ and enter a project name.

3. Click ‘Create project’ and then click ‘Create a new blipp.’

4. Name your blipp (e.g. the article or page number within a magazine, image title, etc.)

5. Click on the gray box with the dashed line to upload a marker.
   - A marker is the image that will trigger your blipp.
   - Markers must be JPEG or PNG format.
   - For more information, see “Choosing a Marker.”

6. Click ‘Create blipp.’

UPLOADING & FORMATTING YOUR ASSETS
To start building your blipp, begin uploading the assets (i.e. the images, videos, audio or 3D files that form the content of your blipp) that will act as an augmented overlay.

1. Click the ‘Uploads’ button in the top left-hand corner of the page and select the image and video files you want to upload from your computer. Uploaded graphics will appear in the assets panel (this may take a few minutes if you’re uploading multiple images).

2. Drag and drop uploaded graphics onto the marker, displayed in the center of the screen. We will now refer to this area as ‘the stage.’

3. Once you’ve put all your assets on the stage, you can re-size, move, and rotate them using your mouse. Or, for more precise control, use the ‘Transform’ controls in the right-hand panel.

4. Select shapes or icons from the ‘Catalog’ and ‘Widget’ tabs located at the top left-hand corner of the page to insert as an overlay to your image. Define action and settings in the right-hand panel.
TESTING & PUBLISHING YOUR BLIPP

1. Once you’ve finished building your blipp, you’re ready to test it on your mobile device.

2. Download and open the Blippar app (For Android or Apple).

3. Click the ‘preview’ button in the top-right corner of the screen (on your computer).

4. A pop-up will appear displaying the uploading status of your blipp.

5. Once the upload is complete, follow the on-screen instructions to test your blipp. Make sure you enter the code from the pop-up under the ‘More’ tab in the Blippar app on your phone when testing your blipp. Hover your phone over the image to preview your blipp settings.

6. If you’re happy with your blipp and are ready to set it live, click ‘Make it Live.’ The blipp will now be submitted for approval. The Blippar team will get back to you via email to let you know the status of your blipp. This may take 2-3 days.

7. Once approved, people can use the smartphone Blippar app to hover over your designated image and bring your added assets to life.

BLIPPAR ADDITIONAL SUPPORT

Visit Your First Blipp Build.
Developed by a team at Field Day, ARIS is a free, open-source, easy-to-use platform for creating and playing augmented reality experiences on iOS devices (requires an internet connection to play).

ARIS is connected to a live database server to create mobile games, interactive stories, scavenger hunts, tours, and data collection activities involving objects, triggers, and scenes, such as: player location (GPS), QR codes, bluetooth beacons (iBeacons), image recognition, alphanumeric codes, and more.

BEFORE YOU BEGIN

You will need:

- A smart mobile device or tablet
- A desktop or laptop computer
- A collection of assets (images, videos, graphics, etc.) for your desired creation
- An idea of how you want your AR flow to work (what are you creating?)
- Internet access

GETTING STARTED

1. Create an ARIS account. Just fill in the username and password and hit “register”.
2. Download the ARIS app on your mobile device and login with your credentials.
3. Connect and upload target content to a database: ARIS uses Vuforia to host content.
4. On your computer, register for a Vuforia Developer Account
5. Select ‘Develop’ in the top navigation menu
6. Below the main navigation, select ‘License Manager’ and then ‘Get Development Key’ (this will enable a free license)

7. Type ‘ARIS’ for App Name and select ‘Confirm’ to create a free Development License Key

8. Under ‘Target Manager’, click ‘Add Database’

9. Type in the desired database name (such as AR1 or your last name) and select the ‘Device’ option under Type and click ‘Create’
10. Upload your target images (the content users will scan with their smart devices to activate the augmented reality experience)

11. Once all target content is uploaded, click ‘Download Database (All)’ and select ‘Android Studio, Xcode or Visual Studio’ as the development platform. Save the .zip file to a memorable location on your computer.

**CONNECT THE DATABASE TO ARIS**

1. Now that we have the database set up, return to the ARIS editor page.

2. Click ‘New Game’

3. Type in the desired name, a brief description, and click ‘Save’

4. The created database will be used to set AR Targets. In the top navigation, select ‘AR Targets’

5. Click ‘Upload AR Targets’ and choose the .zip file exported from Vuforia. Click ‘Save’ and your content will begin to upload into ARIS.

**BUILD AR IN ARIS**

1. In the top navigation of ARIS, click ‘Media’

2. Upload the remaining collection of assets you gathered before starting the project (video, audio, images, etc.)

3. Now, begin organizing the media into the AR flow: select ‘Scenes’ from the ARIS top navigation.
4. Create an Introduction Plaque to introduce the user to the game

What is a Plaque? A Plaque is an object in ARIS that provides the player with different types of information. A Plaque can display a title, a description, or different types of media (e.g., images, audio, video). It is the most basic kind of game object.

a. In the left sidebar, click the + button next to the Plaques title

b. Fill out the form that appears
   i. Skip ‘Icon’ or ‘Media’ (these are added later)
   ii. Skip Continue Button Function
   iii. Save

5. Create a Trigger that will allow players to access the Introduction Plaque. For ease of use, we will start with the Lock Trigger so our plaque will show up as soon as the game starts.

What is a Trigger? Triggers allow players to access objects. There are four basic types of Triggers:

GPS Trigger - (default) A set of GPS coordinates an object is connected to. Typically, but not exclusively, the player must physically travel to these coordinates to access the object.

QR Code Trigger - A scannable pattern that an object is attached to. Typically, the player must use the built-in scanner in ARIS to scan this image in order to access the object.

Lock Trigger - A Trigger that will be displayed on the screen as soon as any “locks” associated with it are met. If no “locks” are set (which is the default state) the object will automatically appear on the screen.

Timer - A Trigger that will activate on regular set intervals (so long as all of the locks have been satisfied).

a. Click on the “Scenes” tab in the top navigation.

b. Click on the + next to the “Starting Scene”.

AN INTRODUCTION TO AUGMENTED REALITY
c. Click on “Plaque” and select your “Introduction” Plaque from the list. This will create a Trigger for your Plaque. The new Trigger will appear in the Starting Scene.

d. Click on the newly created Trigger (inside the Starting Scene). This will load the Plaque Trigger settings in the right sidebar which will allow you to specify when and how players will be able to view it.

e. To make the Plaque appear as soon as a player starts the game, set the Trigger to use "Locks".

f. Do not define any locks.

g. Save.

6. Add additional content and scenes to the editor and set desired triggers for each scene. (ARIS offers a variety of tools to be augmented, such as conversations, plaques, player attributes/items, web pages, events, and more. Play around with what fits for your content!)

   **Note:** Simply adding content to the ARIS editor in scenes will not make them visible. The content you create will only be visible on the app when it has a trigger attached to it. Triggers are created inside of Scenes. Once you’ve added a Trigger to a Scene, you can adjust the Trigger Settings in the right sidebar to set when and how players will be able to access the Trigger.

**TEST YOUR ARIS GAME**

Log in to ARIS on your iOS device (using the same username/password you created for the editor). Then, click on “Mine” in the bottom tab bar. Your game should appear in the list. When you start the the game (by clicking on “New Game”) the Introduction should pop up.

Keep adding content and scenes to the editor and define triggers for each scene to build your AR experience. Connect and order scenes by clicking the + icon in the scene box and select the scene you would like to move to next. Each scene must have its own trigger defined in order to work.
PUBLISH YOUR ARIS GAME

Publishing a game basically means that you are making it public for other people to play. So, if you want other people to play your game, you need to do the following:

1. In the editor click on “Game” and then “Settings”
2. Under “Visibility to ARIS Client” click on “Published”

Share your new AR game with others and have fun!

ADDITIONAL RESOURCES


Video Tutorial: https://fielddaylab.wisc.edu/courses/aris-ar

Step-by-Step starter game walkthrough: tinyurl.com/arishowto

DIG DEEPER

Learn About Quests: http://manual.arisgames.org/editor/quests

Learn About Adding Locks: http://manual.arisgames.org/editor/locks
SECTION 3:
STUDY OBJECTIVE, METHODS, AND RESULTS
OBJECTIVE
This exploratory pedagogical study investigated the impact of Augmented Reality on student content development, course understanding, and professional practice.

METHODS
The first step in our methodology involved locating and gathering insight on various creation tools for augmented reality. To locate tools, we looked at lists provided by tech blogging sites for top AR tools as well as exhibitor lists from popular AR conferences, such as Augmented World Expo (AWE). In browsing through various tools, additional search term options emerged. This enabled additional search terms such as:

- AR for education
- Marker-based AR
- Markerless AR
- LLA AR Tools (Latitude-Longitude-Altitude)
- SLAM technology AR

Upon locating a tool, we asked these following questions:

1. Is it free? If not, what is the cost?
2. Does it require code? (Is it a quick editor or a software development kit?)
3. What form of AR marking/tracking does it use? (Marker vs. Markerless)
4. What key features does it have? What can it make? How will it help pedagogy?
5. What are its limitations?

We often overlooked tools that were not free for our purposes of finding an accessible program for university students. In addition, since the average student does not have much coding literacy, tools that required code were also brushed over. We desired to find a markerless tool, but those often required some form of code; therefore, we had to settle on marker-based AR tools. The last two questions listed above helped compare the simplicity and effectiveness of each tool as we analyzed them for our purposes.

We then developed a comparison list (see Section 1 of this document), separating AR creation tools into two separate categories: Quick Editors (for beginner to intermediate levels) and Software Development Kits (for advanced level creation). From this, we determined three top tools for students to create augmented experiences: (1) ZapWorks, (2) Blippar, and (3) ARIS.
Deployments

To enhance student understanding of coursework through development of augmented reality content, we organized six class deployments at the University of Minnesota, Twin Cities campus, three of which partnered with an international class at the University of Trieste, Italy as an introduction and partnership for global virtual team members. Students used online an AR creation program, ZapWorks, to develop AR content for use in their current coursework. At the time, we found ZapWorks to be the most user-friendly because

1. it offers various levels of challenge (from drag-and-drop interface to design-your-own) for students to work with,

2. ZapWorks does not require an approval timeframe, making it more time-sensitive than other tools, and

3. it allows for up to five free creations under the “Personal” profile.

We individualized each class deployment to fit the specific course curriculum. The teacher and students were provided with a set of instructions for all three levels of ZapWorks (Widgets, Designer, and Studio) as seen later on within this document.

The class number, title, and the specific AR creation objective for each class included:

- WRIT 1301, University Writing – AR to “augment” posters
- WRIT 3029, Business and Professional Writing – résumés, professional identity
- WRIT 3577, Rhetoric, Technology, and the Internet – blogs
- WRIT 3562 (Section A and B), Technical and Professional Writing – instructions, technical descriptions
- WRIT 4562, International Professional Communication – introductions for global virtual team members

As part of online course forums, in-class discussion, or contributions to shared Google docs, students reported on their content development efforts and its effect on their understanding and future academic and/or professional work. Discourse analysis was used to identify main themes in these discussions. Student AR content was further studied for identification of cultural dimensions.
Each teacher developed a set of questions to coordinate AR with their current coursework, listed below.

- **WRIT 1301, University Writing** – March 7th, 2018 – AR to “augment” posters
  - How does having the option to use AR affect the invention process?
  - How can using AR make your arguments more persuasive?
  - In what rhetorical situations would AR be most appropriate and effective for connecting with your audience?

- **WRIT 3029, Business and Professional Writing** – February 14th, 2018 – résumés, professional identity
  - What do you see as the future of professional/workplace practices and genres with regards to AR development?
  - How might you utilize AR to enrich your professional (identity) presentation?
  - What are some to AR use in the workplace?

- **WRIT 3577, Rhetoric, Technology, and the Internet** – April 12th, 2018 – blogs
  - What are the histories of today’s technologies and uses of AR?
  - In what ways can AR be rhetorical? Who are the audiences/authors? What are the purposes?
  - What does the very very near future for AR hold? How could it influence political and social justice issues?

- **WRIT 3562, Technical and Professional Writing** (Partnered with the University of Trieste), – **Section A:** February 28th and March 5th, 2018; **Section B:** March 2nd and 5th, 2018 – instructions, technical descriptions
  - How can we use AR to express U.S. culture?

- **WRIT 4562, International Professional Communication** (Partnered with the University of Trieste) – Ongoing online, Spring 2018 – introductions for global virtual team members
  - How can we use AR to introduce American culture and personal learning networks internationally?
  - How does a student as part of a global virtual team understand, move between and relate to the various components (widgets) included as part of AR created by his/her partner?
  - How does a student identify and isolate AR attributes of most interest?
  - How might such entry-level AR use help a student to understand another culture in more depth? What materialities of each culture do students share?
With the interest of further developing AR for use in general academic and/or professional work, however, we asked the following six questions across course discussions relating to student creation and experience of AR through ZapWorks.

1. What did you include and why?
2. What were some challenges you faced?
3. What did you enjoy about the AR creation and experience?
4. How do you see AR being used within your own field of study/career?
5. Do you see AR becoming popular in the next 5 years or so?
6. Would you share this with your friends?

From this feedback, we coded the discussion notes into the following categories:

1. AR elements (i.e. pictures, video, music, etc.)
2. Positive/enjoyable feedback
3. Challenges/limits
4. Implications for individual fields/careers
5. The future of AR
6. Sharing about AR

RESULTS
The feedback we received offered insightful information to advance our understanding of the impact of student development of Augmented Reality on content development, cultural understanding, and professional practice.

1. AR ELEMENTS
The majority of students opted to use ZapWorks Widgets to create their augmented experience. ZapWorks Widgets is a simple drag-and-drop AR tool that uses a marker-based code (called a ZapCode) to bring the augmented setup to life by downloading the Zappar app on a smartphone and scanning the code. Students used ZapWorks Widgets to fit their assignment instructions. ZapWorks Widgets offers a limited amount of options to include; elements varied from photo gallery collections, individual images, videos, personal portfolio or social media account links, links to informational websites, graphics, and text images. Students emphasized that they selected their items to include as a way to “show rather than tell” (student from WRIT 3029) the topic or theme their project was connected to. Many students also chose to add their own captions to each included widget. In
addition, many students also added a favorite song to play in the background while the user viewed their augmented material on their smartphone.

One group used the Designer level and one individual used the Studio level for their AR creation.

Examples from each class deployment can be viewed below. Download the Zappar app to your smartphone and scan the code to view the content.
WRIT 3029 – résumés, professional identity

By S. Simonett
Includes five widgets: videos related to area of study, two image galleries, one website link (connects to LinkedIn), and automatic background music.

By J. Li
Includes three widgets: a contact card, single image labeled “work experience”, image labeled “education”, and a custom central home image.

By B. Flasch
Includes two widgets: a gallery and LinkedIn link. Maintains the automated background song.
WRIT 3577 – blogs

By A. Lundstrom

Put together using ZapWorks Studio. Contains graphics and images that link to additional information on piracy.

WRIT 3562 (Section A)– instructions, technical descriptions

By K. Place
Uses one song, three Galleries, and four personal web links.
Includes personalized background song.

By G. Vang
Widgets include: a contact card, a link, one song, one video, and four galleries.
Also includes personal background song
Something unique is that one gallery is a collection of favorite poems; most galleries people have been using include photos of themselves.

By D. Moua
Content includes one contact card, three photo albums, and three links
Uses the default background song.
Explores various code designs.
### WRIT 3562 (Section B) – instructions, technical descriptions

<table>
<thead>
<tr>
<th>By M. Mraz</th>
<th>By T. Pearson</th>
<th>By S. Edwards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uses personalized background music. Includes the maximum eight widgets: seven images with captions and one video to describe/show personal interests, family, and events. Also adds a unique central image.</td>
<td>Uses the maximum eight widgets, all photos, to share information on school, family/friends, favorite movies, food, and sports teams. Maintains the automatic Zap symbol as the central image, but adds personal background music.</td>
<td>Includes five captioned widgets (four galleries and one video) to share about interests/hobbies, loved ones, hometown and education, family and pets, and a favorite song. Uses a unique central image and personalized song.</td>
</tr>
</tbody>
</table>

### WRIT 4562 – introductions for global virtual team members

| Developed by a student from the University of Minnesota. Contains eight widgets of content related to Minnesota, including image galleries, website links, and YouTube videos | Developed by a student from the University of Trieste, Italy. Contains five widgets of content related to Italy, including image galleries, website links, and a video with English translations. |
2. **POSITIVE / ENJOYABLE FEEDBACK**

Many students first seemed skeptical or unsure of the augmented experience, not fully understanding what AR is, what can be made with AR, or how it would fit in with their project. Many felt that “we’re not the type of people to create these things” (1301 student). By the end of each deployment assignment, classes concluded that their work with AR via ZapWorks was a unique and enjoyable experience and AR creation is easier than expected.

- AR allowed students to extend professional identity by making a “more visually engaging” experience, allowing students to showcase more of their personality, and include items not found on a traditional résumé. (feedback from WRIT 3029 students).
- ZapWorks was easy to use; everyone was able to create a ZapCode
- “It was easier to work with than I thought… I thought AR was complex and only done with programming” (WRIT 3029 student).
- The ZapWorks Widgets Dashboard was easy to use.
- “This is unexplored territory for me… the tool makes it easy” (WRIT 3562 Section A student).
- WRIT 3562 Section A rated ZapWorks Widgets on a scale of 1-10, with 1 being incredibly easy and 10 being very difficult, convulsing that the tool would be placed between a 2-3 (the limitations and overly-basic setup were factors for this general rating).
- Students from WRIT 3562 Section B enjoyed the fact that people who don’t know any coding languages can create AR on a simple level: “this platform was easy to use for not having prior experience.”
- From the deployments, students commented that they did not fully know the difference between augmented reality (AR) and virtual reality (VR), but this project raised their awareness of how AR is present and used in daily life.
- Students enjoyed the ability to access videos in an augmented way on posters rather than having to read a lot of text: “the project was cool because you could add video to speak over information… more cool than just sitting there reading small type”; “reading written content isn’t as attractive” (WRIT 1301 students).
- One student from WRIT 3577 commented how they enjoyed AR more than VR because full immersion can be scary; AR allows the user to still be present in the real world, assisting with anxiety and claustrophobic feelings.
3. CHALLENGES / LIMITS

Students pointed out many challenges and limits with both the ZapWorks tool and AR in general.

Challenges/limits specific to ZapWorks (particularly the Widgets level):

- Students proclaimed that ZapWorks Widgets was easiest to use, however, it also had the worst presentation or wasn’t as appealing as other AR creations.
- The widgets are too limiting and basic: there is a short list of widget options to choose from and the program only lets you add a certain number of widgets to your experience before meeting a “Zap Limit” and being cut off from adding more content. In addition, students noted that not much personalization is offered. (We suggest that students seeking more personalization would benefit from exploring the Designer or Studio level of ZapWorks).
- The program only takes JPEG images.
- The program orients images in one direction; they are not easy to rotate to their proper state.
- Some images became distorted to fit cropping constraints.
- Students often found it hard to work the code into the content. They felt the assignment could have been completed without the AR experience.
- Widget captions get cut off after a certain length and the user is unable to read the remaining caption text. See R. Peterson’s example from WRIT 3562, Section A, shown below. This student writes in the caption, “I enjoy taking pictures of scen…” but users are cut off from reading the rest.
  
  \[R. Peterson’s ZapCode, WRIT 3562 Section A\]
  Download the Zappar app and scan with a smartphone to view

- Many students raised the issue of not being able to caption individual images within the gallery widget. In addition, students wanted the ability to zoom in or enlarge an image when viewing it on their smartphone.
- One student commented that they would like the ability to embed items into the picture itself.
- Students found frustration in organizing the widgets: they could not drag items around to place them in the desired order; rather, they had to delete and re-upload widget items according to the desired order.
- Of all the class deployments, we encountered one group who was unable to get their ZapCode to work. The code was tested on multiple devices without
success, but the student who created the ZapCode content was absent and we were unable to look at the development itself.

‣ With group assignments, we encountered issues of collaboration: ZapWorks does not allow for other users to collaborate on other projects easily; creation is in the hands of one person.

‣ Users found text-heavy content to be hard to read on screens; AR is more effective for visual presentation rather than written.

‣ Students noted that the Zappar app itself was confusing; they were unsure how to scan a new code or go back to the other content.

‣ Students noted that they wished they had more time to explore and figure out the tool during class.

‣ Students and faculty were both questioning how to capture the experience; once it’s over, it’s over—how do we review or remember what we saw and learned?

Challenges/limits related to general AR:

‣ How would people know how to access this experience?

‣ AR hasn’t quite caught on yet as a popular or traditional thing.

‣ What about people who do not have access to the technology to create or view these experience? What kind of digital divide will this create? (We encountered one student who experienced this exclusivity because they did not own a smartphone).

‣ Many people have limited storage on their phone and do not have room (or do not see the value in) downloading an additional app to view AR.

‣ With the pedagogical study, one student from WRIT 1301 commented that the project’s purpose and use of a new platform seemed random, not quite fitting into their coursework.

‣ Students saw the potential of AR as limiting in itself; they expressed wanting to see more examples of where it is being used in real life.

‣ One challenge AR brings is communication: “with everyone looking at their phones and experiencing AR, no conversations are happening” (student from WRIT 1301). In this deployment, students also pointed out that people were talking about the technology rather than their project content on their posters.

‣ In the WRIT 1301 deployment, students presented posters and noticed that viewers were torn between listening to the presenter and trying to scan the code, raising issue regarding attention and focus.
4. IMPLICATIONS FOR INDIVIDUAL FIELDS / CAREERS

One of our goals was to investigate the impact of student development of Augmented Reality on professional practice. To understand the student prospective, we asked them to consider how AR might be used within their own field of study and future career. Here are some of the answers we received.

- It can be used in architecture to model construction or see buildings in more depth.
- With pharmacy, AR could be used to display drug information or virtually display what the patient is supposed to do when taking their medication.
- With mental health, AR can be used for people to have a virtual puppy, assist with elder care, overall give people more opportunities.
- In business, AR can aid in making more interactive and interesting presentations.
- With marketing, AR can be used on posters as a “learn more” option.
- Agriculture holds implications for plant identification and emphasizing individual aspects of the plant. In addition, it could provide others with virtual farm experiences, such as “real pig farming”.
- In nutrition, users might be able to scan labels to gain information on health facts and serving sizes.
- In university settings, AR can be used to introduce classmates to one another.
- As a software development major, AR could be used to demonstrate skillset within a résumé.
- At conservatories or zoos, AR could be incorporated to provide additional information on the animal or species.
- In the medical field, AR holds potential for showing procedures in real-time.
- With the Italian partners, AR was a good way to share about cultural differences such as football rules.
- Regarding adventure and traveling, one student (WRIT 3577) proposed using AR to have scuba divers preview diving spots in an area.
- Another student (WRIT 3577) suggested creating an AR app to help locate lost items in a house.
- With analytics, one might be able to create unique interactive graphs using AR.
5. THE FUTURE OF AR

- Students from WRIT 3562 Section A brought up a question of copyright: where are we crossing the line with using someone else’s work or using items that are not our own within our created AR experience? What legal issues will this bring as AR develops/popularizes?

- Many people do not want to take the time to have an additional experience: “If this is going to be used, all students will need to download an app… if I see something that requires a QR code, I just ignore it and move on” (student from WRIT 1301).

- Two classes (WRIT 3029 and 3562 Section B) noted AR turning the world into something like a *Black Mirror* episode where we can have out-of-body experiences and see ourselves augmented in different spaces.

- One student (WRIT 3029) commented that AR and VR might be implanted into our eyes or brains to see the world in different ways.

- Once AR becomes more popular, ZapCodes may be more effective for sharing information, but it’s still a bit off from being mainstream.

- One student (WRIT 3029) pointed out that this project made them consider the limitations of what we do now; AR provides a new and different way to think about communicating and interacting.

- Another student from WRIT 3029 compared AR to a sandbox: it’s hard to see it’s potential, but seeing others use the tool opened up perspective and radical ideas.

- A student from WRIT 3562 Section A pointed out that AR could help condense down documents by replacing text with a marker-based AR option.

- One student from WRIT 3562 Section A suggested adding more AR into learning experiences to add interactive visual activities to curriculum.

- A student from WRIT 3562 Section B commented on AR being used within social media platforms, such as having a code about oneself on a dating app for others to view and have a better understanding of the individual.

- Students from WRIT 3562 Section B and WRIT 3577 proposed having more “layered” information around places you’re walking by, such as viewing street names, what restaurants or cafes have free wifi, or what type of food a restaurant has, even nearby events pop up on your smartphone as you scan your location, or have the area zip code virtually hovering above for quick access.

- Students across deployment courses suggested that the future of AR seems more reasonable if people don’t have to download an additional app to use it. They suggested partnering with top companies such as Apple and Samsung to add AR.
recognition programs directly into the smartphone camera feature. It it was implemented, people might be more likely to participate in AR experiences.

- Students seemed to believe that it will be a few more years before the hype of AR catches on, just like SnapChat took a few years. Again, If I see something that requires a QR code, I just ignore it and move on” (student from WRIT 1301). Once AR is popular and valued, people will be less likely to just “move on” from the experience.

6. SHARING ABOUT AR
In general, students concluded that they would be unlikely to share their ZapCode creation outside of class. However, a few students noted that they showed or talked about it with their parents, who thought it was cool or (with one mother being a teacher) saw potential for it to be used within her own classroom. Students generally also concluded that they are likely to talk about AR with their friends, but their friends would probably hold little interest in having to download an app for it until it becomes more popular. One student from WRIT 3577 commented that she thought the information and AR experience was interesting, but she is not likely to share about it with her friends because she has not yet found the right application that she is truly excited to share about.