

TOOLKIT

Vol. 1

Equipment

5 December 2024

MathICs

Created by: Caroline Kerello, José Carmona Tapia, Francisco Muñoz Berenguel



Co-funded by the Erasmus+ Programme of the European Union



Contents

Introduction	2
1. MEDIA ROOM	3
1.1. Materials for a media room	3
1.2 Physical and technical requirements for a media room.....	7
2. HYBRID ROOM.....	8
2.1 Materials.....	8
2.2 Physical and technical requirements for a hybrid room.....	11
2.3 Conceptual diagram for installation of a hybrid room.....	11
2.4 Connections and cables	13
3. OTHER EQUIPMENTS.....	19
4. HINTS AND TIPS	21
4.1 Installation.....	21
4.2 Configuration and Management	22
4.3 Innovation (NDI Protocol).....	23
4.3.1 NDI Technology	23
4.3.2 NDI Applications in Hybrid Classrooms or Media Rooms.....	23
4.3.3 Recommended Installations	23

Introduction

Although MathICs is not a structural project and so does not seek to make systematic change to policy, it will provide the framework for Higher Education Institutions in Morocco to initiate their own integration of ICTs in the education of mathematics and adopt some or all of the processes.

The toolkit will bring together all the activities that the project have undertaken, providing guideline on how they were implemented, resources and materials that support the implementation of activities, hints and tips, as well as recommendations.

The Volume 1 of the Toolkit of the MathICs project is focusing on the equipment necessary and the installation of facilities for ICTs rooms: a media room and a hybrid room.

The acquisition and installation of the technical material necessary for the development of the activities, including hardware and software, as well as the identification of appropriate facilities for media and hybrid rooms are the first steps in implementing ICTs in the education of mathematics.

1. MEDIA ROOM

1.1. Materials for a media room

Below is the list of materials for a media room.

MATERIALS - MEDIA ROOM			
Article	Designation	Unit of measurement	Quantity
MR1	<p>HOMOGENEOUS CHROMA GREEN BACKGROUND</p> <p><u>Main characteristics:</u> ESDDI Lighting Kit Adjustable Max Size 2.6Mx3M Background Support System 3 Color Backdrop Fabric Photo Studio Softbox Sets Continuous Umbrella Light Stand with Portable Bag or equivalent</p> <ul style="list-style-type: none"> • Kit for professional/home studio. • 3 Background, 3 color background with adjustable stand, length extendable from 26 inch up to 102 inch, width from 60 inch up to 118 inch. 70x110 inch green, white, black cotton backdrop. • 2 Softbox, 20"x28" continuous lighting softbox with stand, min 27inch, maximum 80 inch, with E27 bulb holder, perfect for portrait, costume, furnishing, naturally soften light stream and remove shadow for perfect shooting. • 2 Umbrella, 33 inch diameter lighting umbrellas diffuse light, weaken shadows, make model portrait and product shooting softer and more delicate, get ideal lighting effect by matching with common softbox or flash. Umbrella head 180° adjustable, supply softer light for specific corner. • Package list, 2x 20"x28" softbox window, 2x 33" diameter umbrella, 4x 26-80" extendable steel stand for softbox and umbrella, 4x 85W photography bulb, 2x Switch for umbrella, 3x 70" x 110" /6 x 9 ft cotton backdrop, black, white and green, 2x 26-80" extendable steel stand for background, 4x 29" steel tube for flexible background width, 1x carrying bag, 1x 23.6" reflector, silver/gold, 3x Clamps. 	Unit	01
MR2	<p>DSLR CAMERA WITH VIDEO RECORDING CAPABILITY, WITH EXTERNAL MICROPHONE INPUT AND HDMI OUTPUT</p> <p><u>Main characteristics:</u> NIKON D5600 + AF-S 18-105 VR (Camera + objective) or equivalent</p> <ul style="list-style-type: none"> • Single-lens reflex digital camera • Image sensor: DX, CMOS, 23.5 mm x 15.6 mm. Total pixels: 24.78 million • Image size (pixels): (L) 6000 x 4000, (M) 4496 x 3000, (S) 2992 x 2000 • Storage file formats: NEF (RAW): 12- or 14 bit, compressed, JPEG: JPEG-Baseline compliant with fine (approx. 1 : 4), normal (approx. 1 : 8), or basic (approx. 1 : 16) compression, 	Unit	01

	<p>NEF (RAW)+JPEG: Single photograph recorded in both NEF (RAW) and JPEG formats</p> <ul style="list-style-type: none"> • Storage media: SD, SDHC (UHS-I compliant), SDXC (UHS-I compliant) • Card slot: 1 Secure Digital (SD) card • File system: DCF 2.0, Exif 2.3, PictBridge • Movie - frame size (pixels) and frame rate: 1920 x 1080; 60p (progressive), 50p, 30p, 25p, 24p; 1280 x 720; 60p, 50p, actual frame rates for 60p, 50p, 30p, 25p, and 24p are 59.94, 50, 29.97, 25, and 23.976 fps respectively; options support both high and normal image quality • Movie - file format: MOV • Movie - video compression: H.264/MPEG-4 Advanced Video Coding • Movie - audio recording format: Linear PCM • Movie - audio recording device: Built-in or external stereo microphone; sensitivity adjustable • Movie - ISO sensitivity: ISO 100 to 25600 • USB: Hi-Speed USB, with Micro-USB connector; connection to built-in USB port is recommended • HDMI output: Type C HDMI connector • Audio input: Stereo mini-pin jack (3.5 mm diameter); supports optional ME-1 stereo microphones • Wi-Fi (Wireless LAN) standards: IEEE 802.11b, IEEE 802.11g • Lens AF-S 18-105 VR: Focal distance from 18 – 105 mm. 		
MR3	<p>TRIPOD</p> <p><u>Main characteristics:</u> Kit Mannfroto MVK500190XV or equivalent</p> <ul style="list-style-type: none"> • Front Tilt: -70° / +90° • Head Type: Video/Fluid Head • Leg Type: Single • Leg Angles: 25°, 46°, 66°, 88° • Leg Lock Type: Flip Lock • Leg Sections: 3 • Material: Aluminium 	Unit	01
MR4	<p>MEMORY CARDS</p> <p><u>Main characteristics:</u> SanDisk Extreme PRO SDXC 128GB Class 10 V30 U3 UHS-I or equivalent</p> <ul style="list-style-type: none"> • Format: SD (SDXC) • Capacity: 128 GB • Class: 10 	Unit	04
MR5	<p>WIRELESS XLR LAVALIER MICROPHONE</p> <p><u>Main characteristics:</u> Wireless XLR lapel Sennheiser EW 112P G4 or equivalent</p> <ul style="list-style-type: none"> • Transmitter and receiver condenser lavalier microphone 	Unit	01

	<ul style="list-style-type: none"> • Polar pattern: Omnidirectional • 42 MHz switching bandwidth • 20 Frequency banks with up to 12 presets each • Up to 20 compatible channels • Frequency range: 25 - 18,000 Hz • Frequency transmission via infrared interface • Audio gain 60 dB • 4-Digit battery indicator on the transmitter and receiver • LC display with NF level and channel display • 30 mW transmission power • Includes CL100 cable, CL 1 cable and CA 2 hot shoe adapter 		
MR6	<p>VIDEO CAPTURE / INTEGRATOR</p> <p><u>Main characteristics:</u> Blackmagic Video Assist 7" 12G HDR and Blackmagic Decklink (Mini Recorder Internal Card) or equivalent</p> <p><u>Main characteristics for Video Assist:</u></p> <ul style="list-style-type: none"> • SDI Video Inputs: 1 • SDI Video Outputs: 1 • SDI Rates: 270Mb, 1.5G, 3G, 6G, 12G. • HDMI 2.0a Video Inputs: 1 • HDMI 2.0a Video Outputs: 1 • Analog Audio Inputs: 2 x balanced mini XLR with phantom power • Analog Audio Outputs: 1 x 3.5 mm headphone jack. • Built in Speaker: Mono • Screen Dimensions: 7 inch 1920 x 1200. • Screen Brightness: 2500nits • Screen Color: P3 wide color gamut • SDI Audio Inputs: 16 channels embedded via 12G-SDI • SDI Audio Outputs: 16 channels embedded via 12G-SDI • HDMI Audio Inputs: 8 channels embedded via HDMI 2.0a • HDMI Audio Outputs: 8 channels embedded via HDMI 2.0a • Remote Control: 1 x 2.5mm LANC for Record Start and Stop. • SD Interface: Dual UHS-II SD slots • Storage Type: Removable SDXC UHS-II, SDXC UHS-I and SDHC UHS-I SD cards. • Supports DS, HS, SDR12, SDR25, DDR50, SDR50 and SDR104 SD cards. • Computer Interface: 1 x USB Type-C 3.1 Gen 1 for external drive recording, webcam out, initial setup, software updates and Video Assist Utility software control. <p><u>Main Characteristics for Mini Recorder Internal Card:</u></p> <ul style="list-style-type: none"> • SDI Video Inputs: 1 x 10-bit SD/HD/Ultra HD switchable. • SDI Audio Inputs: 16 channels embedded in SD, HD, Ultra HD. • HDMI Video Inputs: 1 x HDMI 2.0a connector. • HDMI Audio Inputs: 8 Channels embedded in SD, HD, Ultra HD. 	Set	01

	<ul style="list-style-type: none"> Computer Interface: PCI Express 4 lane generation 2, compatible with 4, 8 and 16 lane PCI Express slots. 		
MR7	<p>COMPUTER</p> <p><u>Main characteristics:</u> HP Z2 G4 8TH GEN INTEL® CORE™ i7 i7-8700 16 GB DDR4-SDRAM 512 GB SSD BLACK MINI PC + speakers or equivalent</p> <ul style="list-style-type: none"> CPU Intel i7 8700 RAM: 16 GB DDR4 Hard Drive: 512 GB SSD Graphic Card: Intel UHD 630 	Unit	01
MR8	<p>MONITOR 23,8" Full HD, IPS, 1920x1080, LCD, HDMI</p> <p><u>Main characteristics:</u> HP 24ea, 23,8" Full HD, IPS, 1920x1080, LCD, HDMI or equivalent</p> <ul style="list-style-type: none"> 23,8" Full HD, IPS, 1920x1080, LCD, HDMI 	Unit	02
MR9	<p>HEADPHONES</p> <p><u>Main characteristics:</u> AKG K52 or equivalent</p> <ul style="list-style-type: none"> Closed Design. Impedance: 32 Ohms. Sensitivity: 110dB SPL/V Frequency response: 18 - 20000Hz Max. input power: 200mW 2.5m cable with 3.5mm connector and 6.3mm adaptor. 	Unit	01
M10	<p>TELEVISION LED 40"</p> <p><u>Main characteristics:</u> TV LED 40" or equivalent</p> <ul style="list-style-type: none"> HMDI IN 	Unit	01
M11	<p>LAPTOP</p> <p><u>Main characteristics:</u> HP ENVY 13-aq1000ns or equivalent</p> <ul style="list-style-type: none"> CPU Intel Core™ i5 RAM: 16 GB DDR4 Hard Drive: 512 GB SSD Graphic Card: NVIDIA® GeForce® MX250 Screen : 13 inches 	Unit	01
M12	<p>PRINTER</p> <p><u>Main characteristics:</u> HP JetPro 500 color M570dn or equivalent</p> <ul style="list-style-type: none"> Laser Color 	Unit	01

1.2 Physical and technical requirements for a media room

REQUIREMENTS – MEDIA ROOM	
Physical and technical requirements	Description
Minimum space of 40 m²	Normal classroom or office space (no columns)
Natural lighting	No natural lighting, but if there are windows they should be covered with blackout curtains.
Artificial lighting	Cool-white light (fluorescent tubes in ceiling or energy-saving bulbs from 3500° K), which will be complemented with additional floor lamps in the equipment.
Electricity and electric power	At least 3 electrical outlets on two walls (6 outlets). No additional power is needed beyond that of a normal classroom or office.
Acoustics	Floor-length curtains or blinds on at least 3 walls.
Other	The room should not be located next to transit points or noisy places.

2. HYBRID ROOM

2.1 Materials

MATERIALS – HYBRID ROOM			
Article	Designation	Unit of measurement	Quantity
HR1	<p>LAPTOP</p> <p><u>Main characteristics:</u> HP Z2 G4 8TH GEN INTEL® CORE™ i7 i7-8700 16 GB DDR4-SDRAM 512 GB SSD BLACK MINI PC WORKSTATION or equivalent</p> <ul style="list-style-type: none"> • CPU Intel i7 8700 • RAM: 16 GB DDR4 • Hard Drive: 512 GB SSD • Graphic Card: Intel UHD 630 	Unit	03
HR2	<p>MAIN TOUCH MONITOR</p> <p><u>Main characteristics:</u> Wacom Cintiq 22" HD or equivalent</p> <ul style="list-style-type: none"> • Screen Size (measured diagonally)15 in / 55 cm • Display Resolution: 1920 x 1080 (Full HD) • Display Technology: IPS • Pen Type: Pressure-sensitive, cordless, battery-free • Pen Technology: electromagnetic resonance technology • Contrast Ratio: 1000:1 (typ) • Brightness:210 cd/m2 (typ) • HDMI port • USB-A port 	Unit	01
HR3	<p>SECONDARY MONITOR</p> <p><u>Main characteristics:</u> HP Monitor 22" or equivalent</p> <ul style="list-style-type: none"> • Full HD, IPS, 1920x1080, LCD, HDMI 	Unit	03
HR4	<p>CABINET (with lock for control)</p> <p><u>Main characteristics:</u> Digitus WardrobeMural 10" 6U 254mm or equivalent</p> <ul style="list-style-type: none"> • Capacity: 6U 	Unit	02
HR5	<p>HDMI FULL HD PROJECTORS</p> <p><u>Main characteristics:</u> EPSON PowerLite L500W WXGA 3LCD Laser Projector or equivalent</p> <ul style="list-style-type: none"> • Projection System: Laser • 5000 Lumens 	Unit	02

	<ul style="list-style-type: none"> • Aspect Ratio: 16:10 or 1920 x 1080 • Resolution: 1280 x 800 (WXGA) or 1920 x 1080 <p><u>Interfaces:</u></p> <ul style="list-style-type: none"> • 2x HDMI • Analog: D-sub 15 pin • 1x Control I/O: RS-232C D-sub 9 pin • USB-I/O: Type A 1x; Type B 1x • Wired LAN RJ45 • Wireless LAN Optional Accessory • Audio in (stereo): 2x • Audio out (stereo): 1x 		
HR6	<p>PROJECTION SCREEN</p> <p><u>Main characteristics:</u> Celexon PureWhite 300 x 187 cm</p> <ul style="list-style-type: none"> • Matte white frame display for projector • 16:10 format • Visible field of view projected image size 300 x 187 (minimum required) • Non-motorized. 	Unit	02
HR7	<p>CAMERA SDI-NDI PTZ</p> <p><u>Main characteristics:</u> Cameras PTZ OPTICS model PT12X-NDI or equivalent</p> <ul style="list-style-type: none"> • Pan/Tilt/Zoom • 12x Optical Zoom • 72.5° Field of View • SDI • HDMI • NDI • 1080P @ 60 FPS Resolution • IP Streaming (NDI/RTSP/RTMPS) • Serial Control (RS-232/RS-485) • 3.5mm Audio Input (HDMI & IP Stream Only) • Panasonic CMOS Sensor • Wide Dynamic Range • PoE 	Unit	02
HR8	<p>AUDIO/VIDEO INTEGRATOR</p> <p><u>Main characteristics:</u></p> <ul style="list-style-type: none"> • 1 Blackmagic Smart Videohub Cleanswitch 12x12 or equivalent • 1 Blackmagic ATEM Mini PRO ISO or equivalent • 1 Blackmagic Hyperdeck Studio Mini or equivalent • 1 PACK: Biamp MRB-L-VT4-C (Certified large room bundle with white ceiling microphones) or equivalent • 2 Blackmagic Mini Recorder (PCIE Internal Cards) or equivalent • 1 BirdDog Studio NDI or equivalent 	Unit	1

	<ul style="list-style-type: none"> • 1 Wireless XLR lapel Sennheiser EW 112P G4 or equivalent • 1 Behringer Xenyx Q802 USB or equivalent • 4 Converters Blackmagic HDMI to SDI or equivalent • 5 Converters Blackmagic SDI to HDMI or equivalent • 3 Google Chromecast or equivalent <p>Although equivalent items can be purchased, the products and brands described are recommended, because they are already proven to work together. Any modification may change the characteristics of the other products in this section. If an item is not available, please consult us.</p>		
HR9	<p>ELECTRONIC WHITE BOARD</p> <p><u>Main characteristics:</u> White Board PROMETHEAN ActivPanel Nickel 86" or equivalent</p> <ul style="list-style-type: none"> • Diagonal Size 86" • Screen Type: TFT LCD (Direct LED Backlight) • Display Area: 1895 x 1066 mm • Resolution: 4K UHD (3840 x 2160 @ 60 Hz) • Response Time: 8 ms • Panel Refresh Rate: 60 Hz • Brightness: 400 cd/m² • Contrast Ratio: 4000:1 <p><u>Connectivity:</u></p> <ul style="list-style-type: none"> • HDMI® 2.0 In (Rear) • HDMI 2.0 In (Front) • VGA In • VGA Audio In • USB-A 2.0 (Rear) • USB-A 2.0 (Front) • USB-A 3.0 (faster data transfer, Front) • USB-B Touch (Rear) • USB-B Touch (Front) • USB-C PD2.0, USB 2.0, DP1.2 (Rear) • Mic In (3.5 mm) • Headphone <p><u>Interactivity:</u></p> <ul style="list-style-type: none"> • Response Time: 10 ms 	Unit	01
HR10	<p>SOFTWARE</p> <p><u>Main characteristics:</u> Adobe Connect license "Webinar Manager 100"</p>	Unit	01
HR11	<p>SOFTWARE</p> <p><u>Main characteristics:</u> ZOOM license « PRO »</p>	Unit	01

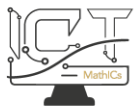
2.2 Physical and technical requirements for a hybrid room

REQUIREMENTS – HYBRID ROOM	
Physical and technical requirements	Description
Minimum space of 50 m ²	<ul style="list-style-type: none"> • Classroom space (no columns). • Room not too elongated. It is desirable as square as possible or a normal ratio of approximately 4:3. • At least two walls should be windowless in order to be able to install a screen.
Electricity and electric power	<ul style="list-style-type: none"> • At least 3 electrical outlets on each wall. • A minimum of 4 internet wall outlets (in practice two outlets are needed but there must be the possibility of connecting switches to multiply the effective and IP outlets). • The differential switch must support at least the same load as a computer room with 30 computers.
Natural lighting	It is desirable whenever possible but with light-colored blinds or curtains on windows.
Artificial lighting	None in particular, although it is preferable to have at least two phases that can be activated independently so that only half of the lights can be activated when necessary
Acoustics	No acoustic insulation is required in the walls, but curtains are desirable. Curtains provide better acoustics by eliminating echoes from empty rooms.

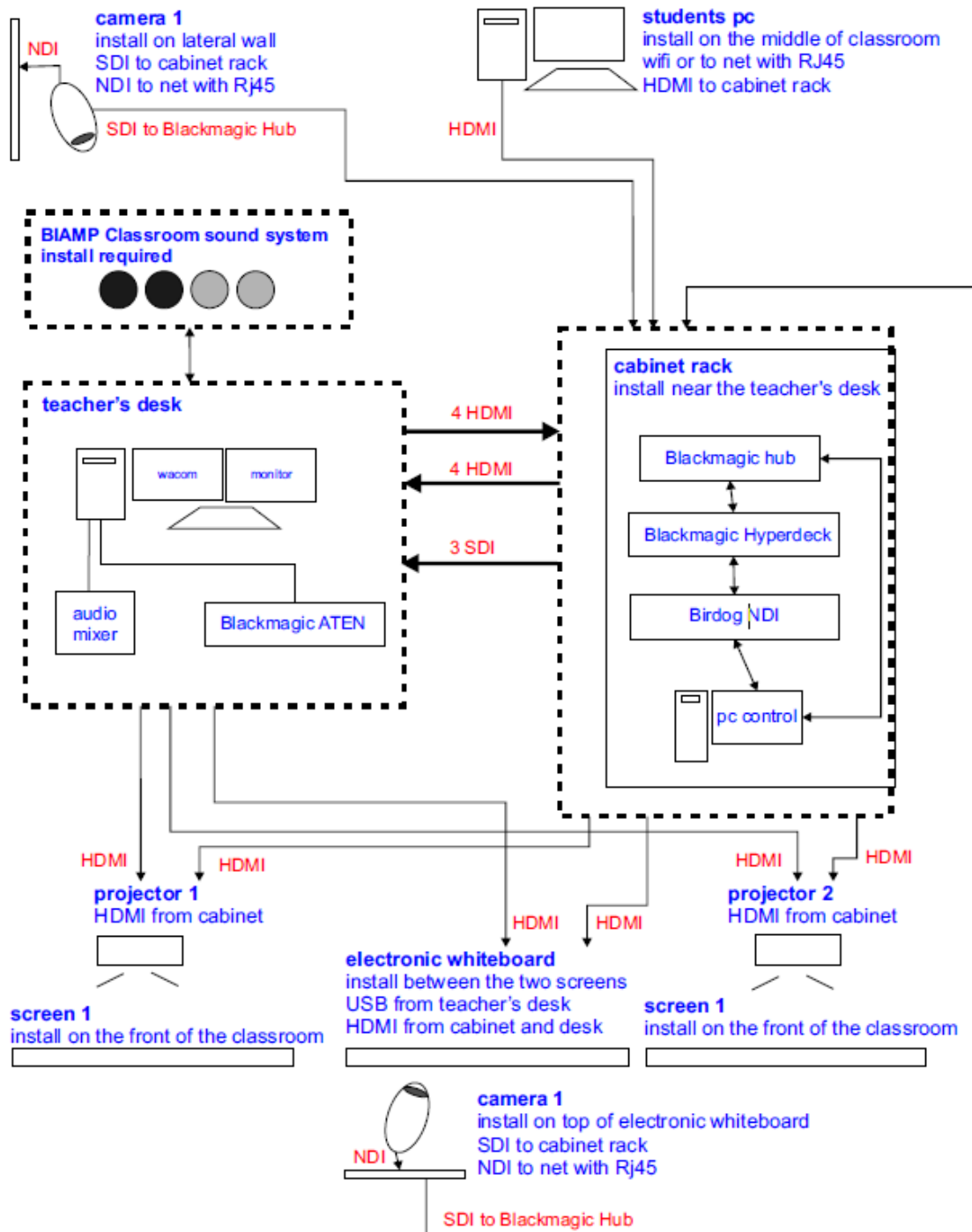
2.3 Conceptual diagram for installation of a hybrid room

The diagram below is a suggestion of location and installation. The location may change according to the classroom.

- The BIAMP classroom system sound must be installed and configured: microphones, speakers and set up on the teacher’s computer.
- All devices that have a network socket must be connected by cable to the network (RJ45): cameras, computers, projectors, NDI devices, etc.
- The cabinet rack should be as close to the teacher’s desk as possible.
- The SDI cables from the cameras go to the cabinet rack.
- The teacher has two screens: Wacom and monitor. These two screens should be able to be displayed directly on screen 1 and screen 2. They must also go the cabinet rack.
- The electronic whiteboard must be installed and connected by USB to the teacher’s computer.
- Cables of sufficient length to interconnect devices must be provided:
 - Between cabinet rack devices:
 - 8 SDI cables
 - 6 HDMI cables



- 6 USB3 cables
- Between cabinet rack and teacher desk:
 - 3 SDI cables
 - 8 HDMI cables
 - 6 USB3 cables








2.4 Connections and cables

The following table shows the connections offered in the hybrid room. The university can modify them according to its needs. If the cables are not supplied by the manufacturer, they must be supplied by the installation company or others.















The measurements in meters of the cables are estimated, this will depend on the dimensions of the room. When converting HDMI signals to SDI or vice versa, it is always convenient that the long stretches are SDI. However, HDMI allows distances of more than 10 meters without problem if the cable is of quality.

Manufacturers often change the specifications of their equipment. Anytime, there is a DisplayPort, a HDMI converter will be needed.

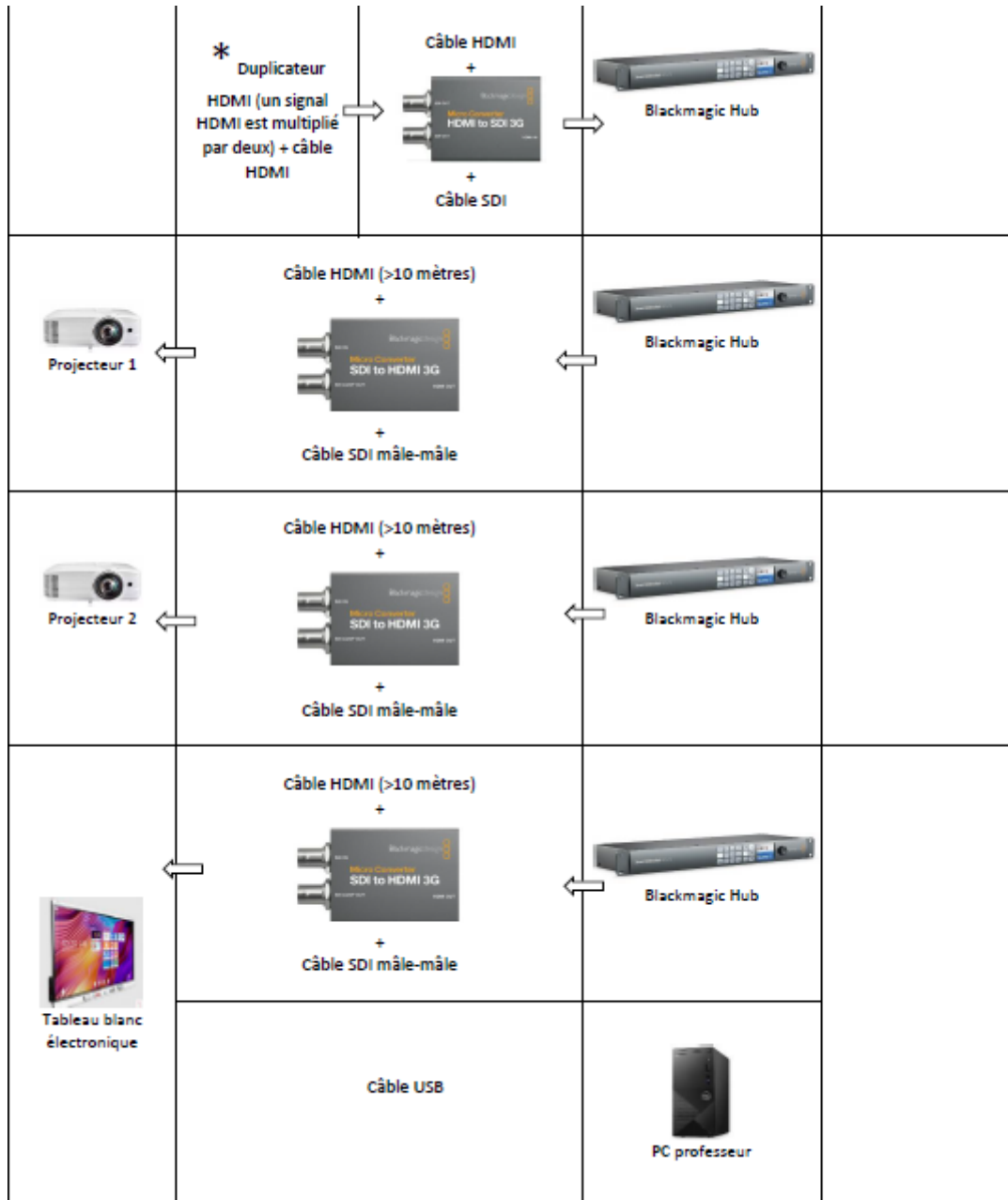
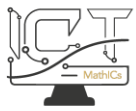
Some necessary peripherals that were not included in the purchase but are necessary (HDMI duplicators, DisplayPort converters and others) are marked with an asterisk.

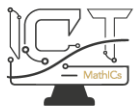
Dispositif	← sont connectés →		Dispositif	Remarques
 Pack BIAMP Audio	Selon les instructions du manuel d'installation BIAMP		 PC Professeur	Suivez les instructions du fabricant pour l'installation des haut-parleurs, des microphones, etc.
 Caméra 1	Câble SDI mâle-mâle (>10m)		 Blackmagic Hub	Réglez la caméra sur 1080p /25 par défaut. Si cela ne fonctionne pas, essayez d'autres configurations.
	Câble réseau (RJ45) connecté au réseau de l'université			<u>Cette connexion est facultative</u> : seulement si l'infrastructure le permet.













 Caméra 2	Câble SDI mâle-mâle (>10m)  Blackmagic Hub		Réglez la caméra sur 1080p /25 par défaut. Si cela ne fonctionne pas, essayez d'autres configurations.
	Cable de red (RJ45) conectado a la red de la universidad 		<u>Esta conexión es opcional</u> : sólo si la infraestructura lo permite.
 PC étudiant	Câble HDMI mâle-mâle (1 mètre) +  + Câble SDI mâle-mâle (5 mètres) 		Ajouter un convertisseur Displayport vers HDMI si nécessaire
	Câble HDMI mâle-mâle  Moniteur étudiant		
 PC Professeur	 * Duplicateur HDMI (un signal HDMI est multiplié par deux) + câble HDMI	Câble HDMI mâle mâle  Monitor Professeur	*
		Câble HDMI +  + Câble SDI  Blackmagic Hub	*
		Câble HDMI mâle mâle  Wacom	












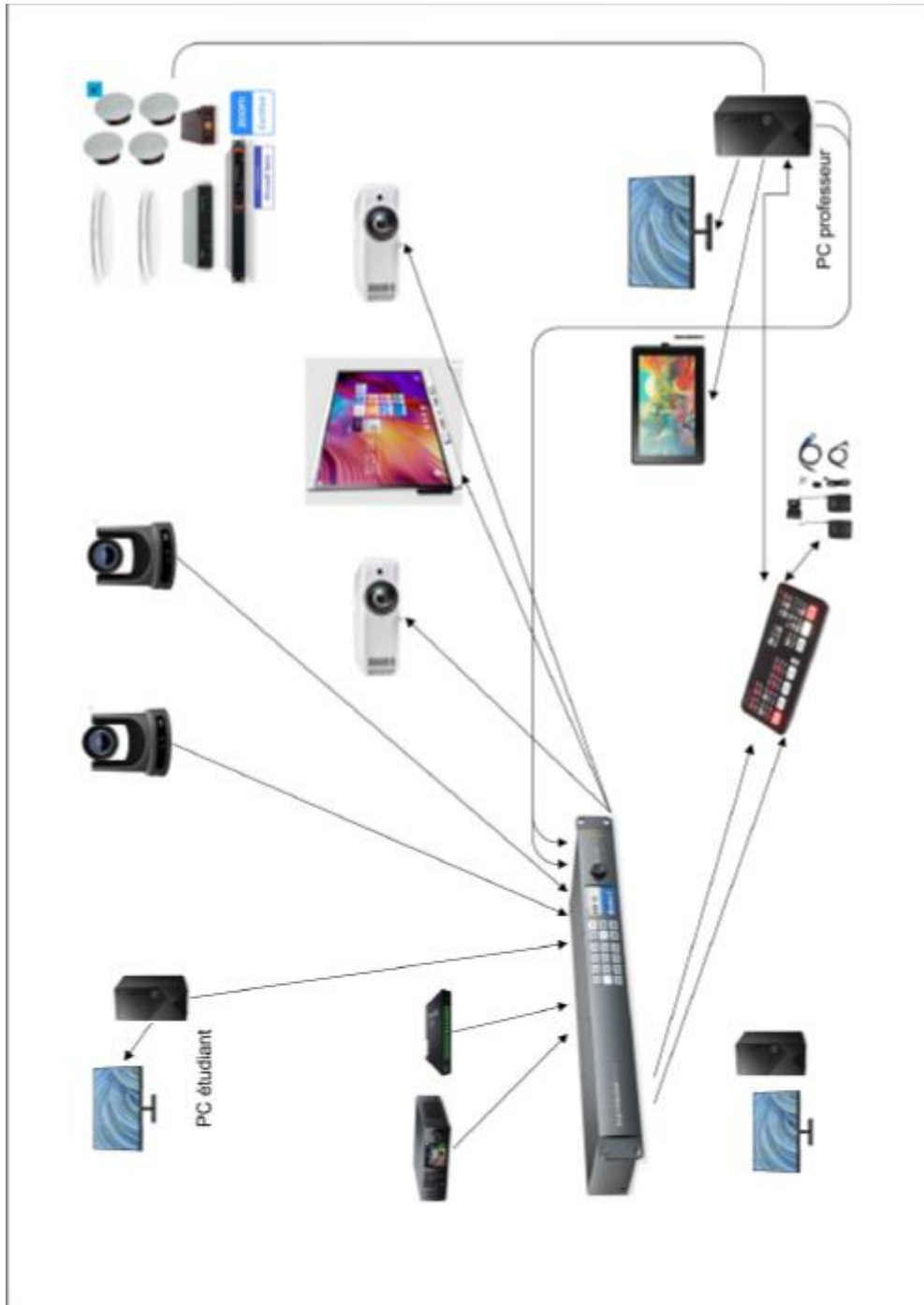
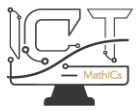




 Wacom	Câble USB	 PC professeur	
 ATEM ISO PRO	Câble USB C	 PC professeur	
	Câble HDMI (>2 mètres) +  + Câble SDI mâle-mâle	 Blackmagic Hub	
	Câble HDMI (>2 mètres) +  + Câble SDI mâle-mâle	 Blackmagic Hub	
 Micro Sennheiser	Câble audio minijack 3.5	 ATEM ISO PRO	Câble inclus dans la boîte Sennheiser

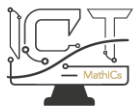


 Birdog NDI Dispositif permettant d'étendre les fonctionnalités. Non utilisé	Câble SDI mâle-mâle Câble réseau (RJ45) connecté au réseau de l'université	 Blackmagic Hub 	
 Hyperdeck	Câble SDI mâle-mâle	 Blackmagic Hub	
 Blackmagic Hub	Câble USB	 PC professeur	
 Dispositif permettant d'étendre les fonctionnalités. Non utilisé			Dispositif permettant d'étendre les fonctionnalités. Non utilisé
 PC CONTROL Dispositif permettant d'étendre les fonctionnalités. Non utilisé			Dispositif permettant d'étendre les fonctionnalités. Non utilisé



3. OTHER EQUIPMENTS

FOR ALL ROOMS			
Article	Designation	Unit of measurement	Quantity
OE1	<p>TOUCHSCREEN LAPTOP</p> <p><u>Main characteristics:</u> Intel Core i5, 128GB SSD, 12,3": Microsoft Surface Pro 8 Intel Core i5-1035G4/8GB/128GB SSD/12.3" Touch Platinum or equivalent</p> <ul style="list-style-type: none"> • CPU : Intel Core i5 • Hard Drive : 128 GB SSD • RAM : 4 GB • Keyboard portable and convertible with the computer • Screen: 12.3" PixelSense™ Display • Resolution: 2736 x 1824 (267 PPI) • Aspect ratio: 3:2 • Touch: 10 point multi-touch • Ambient light sensor • Accelerometer • Gyroscope • Magnetometer 	Unit	01
OE2	<p>LAPTOP SLEEVE WITH KEYBOARD</p> <p><u>Main characteristics:</u> Microsoft Type Cover Signature Charcoal Grey for Surface Pro or equivalent</p>	Unit	01
OE3	<p>DIGITAL PEN</p> <p><u>Main characteristics:</u> Microsoft Surface Pen Black or equivalent</p> <ul style="list-style-type: none"> • Pen Stylus for Surface Pro 7 • Bluetooth • 4096 pressure points and tilt support 	Unit	01
OE4	<p>TABLET</p> <p><u>Main characteristics:</u> Wacom CINTIQ PRO 24 touch Edition</p> <ul style="list-style-type: none"> • For Media Room. • Improves the equipment and allows recording Math sessions with a touch device outside the hybrid room 	Unit	01
OE5	<p>MIXER</p> <p><u>Main characteristics:</u> Blackmagic ATEM Mini Extreme ISO</p>	Unit	01



	<ul style="list-style-type: none">• For Media Room.• Improved editing and viewing options		
OE6	VIDEO EDIT SOFTWARE <u>Main characteristics:</u> License DaVinci Resolve For Media Room. Adds an economical professional option for editing	Unit	01
OE7	NAS <u>Main characteristics:</u> Synology DS420+ <ul style="list-style-type: none">• For all rooms.• Improve network storage	Unit	01
OE8	HARD DRIVES <u>Main characteristics:</u> Seagate Iron Wolf (minimum 8 TB each one) <ul style="list-style-type: none">• For all rooms.• Required for NAS	Unit	04



4. HINTS AND TIPS

Consider the previous installation schemes as a usage recommendation. You can configure the equipment as you see fit according to your needs. It is not necessary to use all the equipment exactly as described.

Versatile devices have been used so that you can change your installation scheme if desired. Below are general hints and tips about installation and management.

4.1 Installation

Spaces	<p><u>Prior Design</u>: Before installing the equipment, draw the ideal layout of the classroom, considering the needs of both the teacher and the students.</p> <p><u>Hybrid Spaces</u>: Think about how to combine face-to-face and virtual zones to maximize functionality.</p>
Lighting	<p><u>Natural</u>: Make use of natural light whenever possible.</p> <p><u>Artificial</u>: Use neutral lighting (approximately 4000 °K) for better views and recording results.</p> <ul style="list-style-type: none"> • Warm (2700 °K): May give an unprofessional appearance. • Cool (7000 °K): Can distort faces and produce unnatural tones.
Sound	<p><u>Echo and Reverberations</u>: Minimize the issues using curtains or furniture elements that absorb sound.</p> <p><u>Space Analysis</u>: Adapt the acoustic design based on the furniture and classroom layout.</p>
Electricity	<p><u>Power Outlets</u>: Ensure sufficient electrical points to avoid excessive use of power strips.</p> <p><u>Scalability</u>: Consult your university's technicians to scale the power (kW) needed for all the equipment.</p>
Ethernet Network	<p><u>Network Points</u>: It is ideal to have Ethernet points close to the devices to minimize the use of additional switches or routers.</p> <p><u>Cable Quality</u>: Use network cables of category Cat 5e or higher to ensure stability and speed.</p> <ul style="list-style-type: none"> • Cat 5e: Up to 1 Gbps. • Cat 6: Up to 10 Gbps at short distances. • Cat 6a or higher: Ideal for high-demand environments or long distances. <p><u>Recommendation</u>: Consult your university's IT team to plan a robust installation.</p> <p><u>Configuration</u>: It is highly recommended to work with your IT team to establish an IP configuration for your equipment. It is advisable for all devices to be on the same subnet. This facilitates usability and sets a foundation for good operation and future innovation (e.g., NDI. See Innovation section).</p>

	<p><u>Labeling</u>: Clearly label network cables with origin, destination, and functionality information.</p>
Audiovisual Cabling	<p>HDMI</p> <ul style="list-style-type: none"> • Use: Close devices, such as projectors, monitors, and computers. • Maximum Distance: 10–15 meters without amplifiers. For longer distances, consider active HDMI cables or extenders. • Advantages: Transmits audio and video in a single cable. • Warning: Use quality cables and test compatibility before installation. Consider active cables if you encounter signal issues.
	<p>SDI</p> <ul style="list-style-type: none"> • Use: Professional environments with long distances (up to 100 meters or more with standard coaxial cables). • Advantages: More robust BNC connectors and less sensitive to interference. • Recommendation: Use SDI for distant cameras or critical connections.
	<p>HDMI-SDI Converters</p> <ul style="list-style-type: none"> • Utility: Allow conversion of HDMI signals to SDI (and vice versa) for installation flexibility. • Standard Video Resolutions Recommended: 1280x720 (720p), 1920x1080 (1080p). • Warning: Ensure all devices share a compatible resolution to avoid failures. The most common errors involve using different resolutions between devices. Example: HDMI-to-SDI and SDI-to-HDMI converters must be configured with the same compatible resolution.
	<p><u>Labeling</u>: Clearly label audiovisual cables with origin, destination, and functionality information.</p>

4.2 Configuration and Management

Video Resolutions	<p>Standards Recommended</p> <ul style="list-style-type: none"> • 1280x720 (720p): Suitable for streaming and low-consumption recordings, Wacom tablets in the classroom, and webcams. • 1920x1080 (1080p): Ideal for projectors and monitors.
	<p>Prior Testing</p> <p>Verify compatibility between devices with different resolutions before final installation.</p> <p><u>Warning</u>: Very high resolutions on monitors or projectors do not guarantee better-perceived quality in the classroom.</p>
Ethernet for Devices	<p>Functionality</p> <p>Most devices today have an Ethernet network port, used for operation or configuration and control. Take advantage of this feature to maximize the device's potential. Consult each device's manual.</p>

Device Management in Windows	<p>When installing many audiovisual devices on Windows computers, the extensive list may complicate optimal use. To simplify:</p> <ul style="list-style-type: none"> • Audio Recording Devices: Set a default and disable unused ones. • Audio Output Devices: Set a default and disable unused ones. • Camera/Webcam Devices: Disable unused ones. • Outcome: This makes it more convenient and faster for the user to start a session (e.g., a videoconference).
-------------------------------------	--

4.3 Innovation (NDI Protocol)

4.3.1 NDI Technology

The NDI (Network Device Interface) protocol allows high-quality video and audio transmission in real-time over a standard Ethernet network. It is widely used in audiovisual productions, such as streaming, recordings, and videoconferences.

- **Technical Overview:** NDI is a video connectivity standard that enables multimedia systems to identify and communicate with one another over IP. It encodes, transmits, and receives high-quality, low-latency, frame-accurate video and audio, and exchanges metadata in real-time. NDI operates bidirectionally with many streams on a shared connection. Its encoding algorithm is resolution and frame rate-independent, supporting 4K resolutions and beyond, along with unlimited floating-point audio channels and custom metadata.
- **Benefits:** Removes the limits of video connectivity.

4.3.2 NDI Applications in Hybrid Classrooms or Media Rooms

- Receive NDI signals from cameras and use them as webcams in Windows (NDI Tools).
- Share the screen of computers through the Ethernet network using NDI.
- Remote control of computers.

In summary, stream all audiovisual signals to the Ethernet network for extensive use and many more possibilities.

4.3.3 Recommended Installations

- **NDI Tools:** <https://ndi.video/tools/>
- **NDI for OBS Plugin:** <https://obsproject.com/forum/resources/distroav-network-audio-video-in-obs-studio-using-ndi%C2%AE-technology.528/>
- **OBS Studio:** <https://obsproject.com/>