Name/Referal Number	[Name Censored] (Subject 1)	[Name Censored] (Subject 2)	[Name Censored] (Subject 3)	[Name Censored] (Subject 4)	[Name Censored] (Subject 5)	[Name Censored] (Subject 6)	[Name Censored] (Subject 7)	[Name Censored] (Subject 8)
Pre-Experiment								
Q1 AR Experience	No Experience	One AR-Goggle game. Otherwise not much	One signular app	Very minimal, occasonal gimmick on things	Knows what they do, never used them before.	No AR experience	No significant experience	No significant experience
Q2 Physics Experience	1st year	1st year	1st year	1st year	1st year	1st year	1st year	1st year
2D Ball Push								
Q0 Expectation	Half parabolic motion, velocity increases at a constant rate. Acceleration constant down	Exactly correct minus accel spike	Exactly correct minus accel spike	Mostly correct, didnt mention accel spike and said Y displacement was a sine graph, no mention of subsequent height loss.	Entirely correct. Mentioned the accel inversion as an elastic collision.	Correct bar collision. Mentioned acceleration in real world wouldn't be constant.	Correct bar collison	Correct bar collision
Q1 Intuative?	Yes, understands what is going on	Yes, bar the couple glitches we had.	Yes, easy to follow.	Intuative to read	Yes, could follow what happened very easily.	Yes, exactly what expected overall (can follow whats happening easily)	Yeah, but had a few issues with velocity at the start. Bad lighting?	Yes, could follow along easily
Q2 Anything stick out?	The upwards acceleration spike on the ground, could not explain what caused it	The accel spike is odd, but I understand whats going on	Accel spike is unpredicted, but can see its due to the bounce. It was noted there is a lot of information.	Red arrow, couldn't tell what was going on, (it was the accel inversion.)	Nothing really sticks out, it was all as expected	Red arrow, represents normal force. Surprised by size.	Surprised by the red arrow, but explained it away nearly instantly.	Didnt expect the red collision, guessed it was the normal force, but wasnt sure why it was so large.
Q3 Can the movement be explained by math models?	Doesnt explain the height not reaching the same level it was dropped from	Displacement not reaching the same height, Accel swapping direction, but couldn't say why.	Accel spike, not reaching the same height.	Said it couldn't describe the loss of energy on the bounce. Didn't mention the accel inversion, but said newtons law could explain it, since its equal but opposite (still partially wrong, energy is lost).	Both the height drop, and the collision.	The red spike. Also noted that velocity doesnt point towards the next displacement node, and found that interesting. Was very pronounced straight after the bounce what was the velocity doing there?	No, 2D equations assume constant values and change in direction we don't have here.	Yes, it can be explained, but not with the 2D models. Requires better math models. 2d models dont explain energy loss or collisons.
Simple Pendulum								
Q0 Expectation	Said the pendulum would go back and forth, could not point out what direction the acceleration would be in. (vel + dis correct)	Left to right in a period of motion, fastest at the centre and slow down until it swaps direction. Acceleration will be in the direction of motion	Periodic displacement, accel max at a peak and slowest at the centre (wrong accel direction)	Made mention of the ideal pendulum equation, said in non-ideal radius gets smaller and period gets smaller. (Forgot exact equation). Said accel points towards centre.	Brought up the damped pendulum equation, got the displacement, velocity and accel all correct.	Back and forth symetrically, wont reach the same height each swing. Acceleration opposes the motion.	Exactly correct explanation.	Mostly correct, but said acceleration was in the same direction as velocity, didn't explicitly say what direction the velocity pointed in (oversight?)
Q1 Intuative?	Yes, though it was easier to read without the echo on. (Turned off for the rest of the experiment)	It was all easy enough to follow, could use it on their own easily enough.	Can see what the arrows are referring too, just took a moment to tell what arrow was what.	Really easy to follow.	yeah, all makes sense	Yep, appears like acceleration is also elasticity/ elastic force. Which is cool. Y readings are especially jittery.	Yes, very clear whats going on.	Yes, had a moment where they wondered what acceleration was going, but caught it pretty quick
Q2 Anything stick out?	Nothing in particular, but it is notable that it slows doesnt and doesnt keep going. Plots were also really nice, espesially the clearer ones.	Got the acceleration wrong, but everything else was pretty much as expected.	Not quite as smooth as expected, but otherwise yeah pretty much. Makes it more jittery then it should be	A few outliers in the graphs, but mostly as expected.	Acceleration value was a bit more jittery than expected, but otherwise fine.	Likes how the green arrow appears to swing kinda like a figure 8 shape.	No, all was as expected, nothing stuck out.	The acceleration for a moment, but otherwise yeah pretty straightforward
Q3 Can the movement be explained by math models?	2D equations of motion and kinetic energy dont fully explain the motion, as it doesn't look like the energy is being conserved at all.	Air resistance explains why it was slowing down, but otherwise can be explained by energy transfer.	KE and PE can ignore it, as the scale doesnt really matter for anything bar gravity. Air resistance matters after a time, but not for one swing.	Apart from the gradual loss of energy, yes.	With simple harmonic montion yes. Or in terms of the sine wave of the motion.	Didnt think it could be explained with any mathematical models.	Yes, refered to the damped pendulum. Though noted it slowed down pretty quickly	Didn't think it could be explained as energy was being lost really quickly, no model explains air resistance well.
Centripedal Motion								
Q0 Expectation	Classic circular motion, acceleration points in, tangellical velocity, all roughly constant.	Accel inwards, velocity travels around.	Accel inwards, velocity outwards at 90 deg.	Accel towards centre, constant speed etc, no energy loss, no comment on vel relative to accel.	Once again, entirely correct. Did mention that you would expect the acceleration to be slightly periodic due to gravity. (Which yes, but accuracy is no where near that good).	Force/Accel inwards, moves with vel/ displacement in a circle.	Exactly correct explaination	Correct, but didnt explicitly mention velocity being perp to accel
Q1 Intuative?	Yes, really easy to follow.	Intuative	Yep, all easy	Couldnt quite get a perfect circle, but still easy to follow.	Yes, easy to follow	Yeah, just not clear at first at why some circles are bigger than others.	Yes, very clear	Understood what was happening
Q2 Anything stick out?	The velocity wasn't quite at a right angle and the values changed a bit more than expected.	Everything appears as expected	All is as expected, velocity not quite at 90 degrees, but can see why its happening	Yep. all as expected	Nothing really stuck out.	Really liked how for each frame, you could see what way the ball would go if the rope was cut.	Velocity wasnt at 90 degrees to accel, wasn't quite sure why.	Said everything made sense yes
Q3 Can the movement be explained by math models?	Yes, pretty easily.	Air resistance and gravity might effect it, but yes it would work.	All can be explained	It being slightly ovular cant be, but mostly yeah	Could mostly be predicted with centripedal motion.	It does explain the motion, but noted that the sinusodal x-y motion is hard to explain, and that they couldnt figure out the math behind it.	Mostly explained, there was a few inaccuracies that meant it didn't exactly line up with theory	Yes, centripedal force could explain it quite well
Post-Experiments								
Q1 General Opinion	Makes things much easier to visually understand, especially the pendulum. Circular motion would work really well when learning for the first time.	Once the few issues are ironed out, it would be really valuable to teach people with.	Really good, but smoothness is the only real issue. (Note: I said issue is most important frames are hardest to read. re-iterate this. AI filter too much for this)	Surprised at how well it worked out	Very cool. Being able to see these quantities rather than just seeing them in diagrams is very hands on. Very unique. Could be extended to torque where it isn't very intuative. The graphs helped. (Overwhelmingly positive)	Really good at visualisation, and shows that you cant really apply textbook math to real life perfectly. Theres always that little something. Good example of wobbly numbers, but still follows mathematical patterns. (models are limited in reality)	Overall a really solid visualisation tool. Would need a bit of polish before use, but thought it was really cool.	Really liked it. Mentioned a better application could see use outside of a physics classroom in real life physics/engineering scenarios.
Q2 How would you like to use it in a lab? Compare?	"if I were to do it myself and have like the application there rather than just like a lecturer doing it in front of me, I think, yes, it would make it much more enjoyable."	Would enjoy using it in tandem with experiments but not to replace them.	To use it as an aid to experiments would be good, wouldn't just want to watch someone use it though.	Would really enjoy using it in a lab, would beat dropping cupcake wrappers.	Would make experiments much clearer, even if its less accurate than the current equipment.	Enjoyed their normal experiments, but gave an example where it could be used as a good aid in a train experiment. Also thought having a live reference rather than an image would have been useful.	Yes, but as an aide and not the point of study, felt it would be best used to enhance experience of existing experiments.	Yes, but they noted they really did not enjoy most first year experiments, but really liked the app.
Q3 Could you have reasoned out gaps without AR?	Wasn't something she would have picked out without using AR. The app makes you question the unexpected.	Might have figured it out given enough time, but the AR definetly helped.	Didnt know accel on pendulum and bounce accel, defintely helped point those out.	Decent chance he could have worked it out if prompted, once it was pointed out he felt he could have figured it out pretty quick.	Predicted everything - Not relevant.	Probably could have said what was happening was true if it was pointed out, but would not have come to that conclusion themselves (red accel arrow Exp1)	Possibly? Figured out things pretty quick with AR, probably could have done the same with an image	Everything but the bounce, would not have occured to them.
Q4 How do you think the app helped with vel/accel visualisations?	Circular tracking helped the most with circular, could have reasoned the 2D ball one.	Worked really well at helping with accel, the velocity was really nice as well though. Could really *see* what was happening.	Velocity was more interesting, bar the accel on the ball bounce which was also interesting. The change in velocity was much nicer to see, as its less intuative.	Very much so easier to visualise.	Definetly best visualisation tool for velocity and accel used so far. The app made these vectors very clear.	"Yeah, I think so. And you could see the ways that you know directions. I think I think the arrows are pretty cool"	Yes, much better than a still image	Yeah, seeing it in real time really helped get how it changed in real time. Could also really see the velocity, acceleration relationship with pendulum especially.