



Creative Emotional Reasoning Computational Tools Fostering Co-Creativity in Learning
Processes

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CO-CREATIVITY EVALUATION ANALYSIS

C²LEARN PROJECT DELIVERABLE NO. D5.4.1

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¹ Very sadly Professor Anna Craft died while this deliverable was being prepared. The team would like to acknowledge her leadership and contribution to the C²Learn project, and all its outcomes, even though she is no longer with us.

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EXECUTIVE SUMMARY

C²Learn at a glance

C²Learn (www.c2learn.eu) is a three-year research project supported by the European Commission through the Seventh Framework Programme (FP7), in the theme of Information and Communications Technologies (ICT) and particularly in the area of Technology-Enhanced Learning (TEL) (FP7 grant agreement no 318480). The project started on 1st November 2012 with the aim to shed new light on, and propose and test concrete ways in which our current understanding of creativity in education and creative thinking, on the one hand, and technology-enhanced learning tools and digital games, on the other hand, can be fruitfully combined to provide young learners and their teachers with innovative opportunities for creative learning. The project designs an innovative digital gaming and social networking environment incorporating diverse computational tools, the use of which can foster co-creativity in learning processes in the context of both formal and informal educational settings. The C²Learn environment or **C²Space** is envisioned as an open-world ‘sandbox’ (non-linear) virtual space enabling learners to freely explore ideas, concepts, and the shared knowledge through participating in **C²Experiences** assisted by the systems artificial intelligence (AI) known as **C²Assistants** (Figure 1). This innovation is co-designed, implemented and tested in systematic interaction and exchange with stakeholders following participatory design and participative evaluation principles. This happens in and around school communities covering a learner age spectrum from 10 to 18+ years.

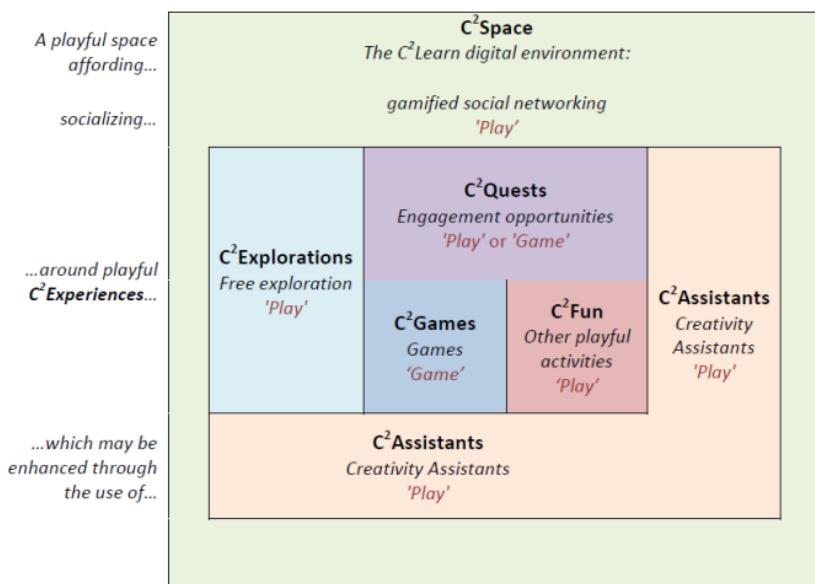


Figure 1: C²Learn's C²Space and its subcomponents

About this document

Deliverable 5.4.1 is the first installment of a document describing the outcomes of **Co-creativity Evaluation Analysis** of data and information gathered through the pilot activities (M21 cycle), following the methodology defined by T2.3. Led by the UEDIN team, in close

collaboration with OU, EA and BMUKK it sets out in detail the qualitative and quantitative analysis performed, according to the defined conceptual foundations and assessment methodology of the project (D2.3.1-2), leading to a synthesis of the pilot findings.

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LIST OF ABBREVIATIONS AND TERMS

A) Abbreviated names of the project consortium partners

Abbreviation	Explanation
EA	Ellinogermaniki Agogi, Greece (coordinator)
UEDIN	The University Of Edinburgh, UK
OU	The Open University, UK
NCSR-D	National Center For Scientific Research "Demokritos", Greece
UoM	Universita ta Malta, Malta
SGI	Serious Games Interactive, Denmark
BMUKK	Bundesministerium Für Unterricht, Kunst Und Kultur, Austria

B) Other abbreviations

Abbreviation	Explanation
CER	Creative Emotional Reasoning

LDS	Living Dialogic Space
MIA	Multimodal Interaction Analysis
SD	Socratic Dialogue
WHC	Wise Humanising Creativity

1. INTRODUCTION

The present document, deliverable **D5.4.1**, is the first installment of a document describing the outcomes of the ***Co-creativity Evaluation Analysis*** of data and information gathered through the pilot activities (M21 cycle), following the methodology defined by T2.3. Led by the UEDIN team, in close collaboration with OU, EA and BMUKK, it sets out in detail the qualitative and quantitative analysis performed, according to the defined conceptual foundations and assessment methodology of the project (D2.3.1-2), leading to a synthesis of the pilot findings.

2. PILOT (M21 CYCLE) ANALYSIS PER SITE

In what follows we present the findings of the qualitative analysis, along with a brief summary of the activities and data collection, performed for M21-cycle Pilot, for each of the 3 sites, i.e. UK, Austria and Greece. It is noted that an overview of all pilot activities of this cycle can be found in deliverable D5.3.2 (C2Learn User Pilots).

2.1 UK ANALYSIS – C²LEARN PILOT: MAY –JUNE 2014

(Primary Analyst at Level 2: Chappel, K.)

2.1.1 ACTIVITY, DATA COLLECTION AND ANALYSIS SUMMARY

Site:SE2

Activity: 2 Year 8 girls and 2 Year 7 boys working with 2 teachers took part in 4 lunchtime sessions, across 4 weeks? of 4Scribes basic paper prototype game play.

Data collection: 1 teacher interview over phone notes embellished post interview; 4 x student axes and creativity wheels completed once after 1st play session; film footage and photographs of play from sessions 1 and session 2 out of 2? taken by teacher; SD interviews carried out by teacher once after session 2

Data processing/open coding in order; by KK: session 1 film footage- rich instances; session 2 film footage – rich instances; axes; wheels; teacher interview.; SD notes sent to UEdin for analysis;

Triangulation: HW blind analysed interview analysis; HW verified KKs film footage analysis

Axial coding in order: Teacher and student interview analysed by KC; rich instances viewed and integrated with interview analysis by KC; axes and wheels integrated with analysis.

Site: SW1

Activity: Up to 12 Year 6 girls and boys worked with 1 teacher x times to play the 4Scribes basic paper prototype game.

Data collection: 1 teacher interview over phone notes embellished post interview;

Data processing/open coding in order; by KK: teacher interview

Triangulation: KC verified KK's analysis

Axial coding in order: KC worked this analysis into the completed analysis from SE2 which had been done previously

2.1.2 FINDINGS

For this case at this point in the piloting there is data available to provide some level of findings in relation to Question 1 and Question 4.

1. How do participants manifest co-creativity (WHC and CER) through C²Learn gameplay?

The analysis for Question 1 uses the Co-creativity categorization framework to structure the Findings:

Overall comments on creativity

There was discussion amongst the SE teachers and comment from the students which hinted at the creativity per se that participants felt might exist within the game which are not explicitly about the five Co-creativity categories. Teachers had mixed views on whether students were being creative in their thinking process. On the one hand they thought they were thinking creatively: "So they had to think about how to link their current card to the story that had already gone and to think about how that card might apply to the story so I suppose in that sense they were having to think quite creatively about how they could fit that card in" [hw2, Triang_19may2014_kk&hw_uk_se2_ss], and "forcing them to discipline their creativity" i.e. linking the themes and settings, cards and ethics. "I thought that was actually quite a good challenge of their ability to create and to make associations and so on and quite good for their thinking skills" [hw6, Triang_19may2014_kk&hw_uk_se2_ss]. On the other hand they thought they weren't thinking creatively enough: "They weren't very good at talking about it (the card) in an abstract sense" [hw3, Triang_19may2014_kk&hw_uk_se2_ss] "They were quite literal, I don't know whether that was because they were the younger side of students we would teach" [hw4, Triang_19may2014_kk&hw_uk_se2_ss] "but they struggled with that" [hw5, Triang_19may2014_kk&hw_uk_se2_ss].

The students also discussed both imagination and creativity per se. Alice discussed how "It would just be about being imaginative". [kc8, sdnotes_19may14_kk_uk_se2_ss], and Toby said: "I found the game creative because I've never done anything like that before". [kc3, sdnotes_19may14_kk_uk_se2_ss]

Attending to ethics and impact of ideas (Generating, exploring and enacting new ideas with valuable community impact (discarding other ideas that do not.)

There is a very small amount of data to indicate that some of the SE students may have been paying attention to ethics and impact. So for example the SE teacher commented on the boys in the disruptor version of the game "messing up somebody else's turn" [kk3,

IA_19may2014_kk_uk_se2_ss] [hw27, Triang_19may2014_kk&hw_uk_se2_ss]. The interviews with the SE young people also showed the young people discussing this – Ewan commented: “One thing I liked was that somebody was pushing it to their ending and you could ruin it for them. That was quite fun” [kc1, sdnnotes_19may14_kk_uk_se2_ss]. And Toby commented: When you could disrupt somebody else by playing an adjective on their characters, because it could really twist the whole game around”. [kc16, sdnnotes_19may14_kk_uk_se2_ss]

When rating themselves on ‘exploring new ideas that make a positive difference’, most of the young people felt that they were doing this at the middle level of quite a lot, and one young person thought they were doing this a lot.

Exploring new ideas that make a positive difference	
Ewan	Quite a lot
Carol	Quite a lot
Alice	A lot
Andrew	Quite a lot

One of the video analysed rich instances showed Carol paying attention to the fact that “when they got back the friends had built a ride”. So, in the story, those who had been left behind were reintegrated into the story. It seems important that there was an awareness that some had been left behind and that it mattered to pay attention to that [36.36, richinstances_9may14_kk_uk_se2_ss].

SE students also discussed thinking about the pros and cons of pushing their ending or that of someone else:

Alice said: “Because people were focusing on getting to their ending rather than making it all make sense as a story.

Carol: Plus the end person had a better chance of winning.

Alice: The person who goes first with their myth card has the worst chance because everyone else can completely change it.

Ewan: But the person who starts it also has an advantage because they can set the theme and everyone else has to keep with that. For example we started with a food fight, so other people had to stick with that.” [kc17, sdnnotes_19may14_kk_uk_se2_ss]

Ewan: “I think it’s important not to give away the ending too early in the game in your contributions, because people might guess that this is your plot so people will try not to let you win.” [kc19, sdnnotes_19may14_kk_uk_se2_ss]

Carol: “I tried to get rid of the worst cards first and keep the ones which would help me to turn it to my ending.” [kc22, sdnnotes_19may14_kk_uk_se2_ss]

Although not referring directly to ethics, there are some hints that the young people might be thinking about the rights and wrongs of how they structure the story and how this impacts on their fellow players.

The SE teacher's perception of ethics was "in the sense of a collaborative effort to create a really good story" [hw30, Triang_19may2014_kk&hw_uk_se2_ss], they did not think the students were thinking in an overtly ethical way [hw28, Triang_19may2014_kk&hw_uk_se2_ss] although they did mention that "the girls did comment on making sure my contribution fitted in with everybody else's" [hw31, Triang_19may2014_kk&hw_uk_se2_ss] demonstrating that the girls were thinking ethically about equal contribution.

In the SW site there was similarly a small amount of evidence for Ethics and Impact awareness from the younger children. The SW teacher related how "One of their characters, Bob, develops throughout...He has a realization about the young woman of emotions, Linda, that she is the cause of another character's bullying" [kk21, Interviewanalysis_30jun2014_kk_uk_sw1_mp]. He also discussed how "in the second game...there is a greater emphasis on that. That's possibly because I know that one of the myth cards that went around the second game was the theme of justice, and so there was a definite attempt by at least one of the players to have the character that was the bully get what was coming to them" [kk7, Interviewanalysis_30jun2014_kk_uk_sw1_mp].

Engaging in dialogue (Posing questions, debating between ideas, finding ways to negotiate conflict or to go in a different direction to others if conflict not resolved.)

The SE teachers thought that there was not much debating and that gameplay was "largely individual" [hw42, Triang_19may2014_kk&hw_uk_se2_ss]. Interestingly two of the SE students' creativity wheel responses support this as they reported that they felt that they only worked with others a bit. The other two students indicated that they felt they did this 'quite a lot':

Working on my own and with other people	
Ewan	Quite a lot
Carol	A bit
Alice	Quite a lot
Andrew	A bit

The SE teachers' interview suggested that the group worked on their own, with slightly more collaboration between the girls [kk16, IA_19may2014_kk_uk_se2_ss] but their collaboration did not seem to impact the play. "The girls would sit and look at each other's cards and they said you can use that one next or that's going to ruin mine" [hw43]. The teacher commented on this: "but then they said today they didn't really factor that in to what they were saying and I don't think that they did actually" [hw39, Triang_19may2014_kk&hw_uk_se2_ss]. This emphasises the importance of the kind of

dialogue that occurs rather than the game simply encouraging discussion or collaboration per se.

The SE analysis also indicated that there were different kinds of collaboration going on. The teacher's interview showed that the forced collaborative element of disruptor play [kk3, IA_19may2014_kk_uk_se2_ss] was enjoyed by some, but it created a competitive element. The two boys commented that they were trying to find ways through the story to support their own ending. Ewan said: "I asked myself what would be good to link to my ending: and Toby commented "I was mainly trying to push it into my direction by keeping my ending in mind" [kc23, sdnnotes_19may14_kk_uk_se2_ss]. In contrast the girls said that they had tried to ensure "my contribution fitted in with everyone else's" [kk10, IA_19may2014_kk_uk_se2_ss]. The students also showed some frustration when their plans were changed by what might be perceived from the outside as an attempt at dialogue from another player: Ewan said "I think it was harder because you might play 'The Young Man of Ideas' because you had a good thought about what to write, but then it messed up your plan if somebody said it had to be the 'tired Young Man of Ideas.'" [kc20, sdnnotes_19may14_kk_uk_se2_ss].

The SE analysis also showed that one of the students especially recognised the importance of difference. Ewan commented that "hearing the endings, because the last person steers it to their ending and this means some people's endings can be completely different". [kc15, sdnnotes_19may14_kk_uk_se2_ss] and also that "there were so many different ideas coming from different people". [kc21, sdnnotes_19may14_kk_uk_se2_ss]

In the SW, there was not especially evidence of dialogue from the teacher's interview. He felt that if children interjected it was because this is what they did rather than it happening because it was necessarily encouraged by the game: "It depends very much on the personalities of the children involved, so some children in the groups were quieter, and I think probably less likely to interject in that way anyway, and there are some that will always have their say" [kk9, Interviewanalysis_30jun2014_kk_uk_sw1_mp]]

Being in control (Taking charge of parts of the creative process (understanding rules of the system, decisions have consequences, making decisions, taking action.)

The SE data shows a variety of takes on the idea of 'Being in control'. At times, the girls showed that they felt constrained by the materials. They indicated that they felt they were not in control, [kk5, IA_19may2014_kk_uk_se2_ss] as they were "having to tailor their contributions towards the cards" [hw32, Triang_19may2014_kk&hw_uk_se2_ss]. Having said this, one of the girls played quite strategically – electing to play a 'hard' card early in the game, as it did not fit with her ending [kk18, IA_19may2014_kk_uk_se2_ss]. At other times, the girls demonstrated they were thinking of ways to control their game "The girls would sit and look at each other's cards and they said you can use that one next or that's going to ruin mine" [hw43, Triang_19may2014_kk&hw_uk_se2_ss] "but then they said today they didn't really factor that in to what they were saying and I don't think that they did actually" [hw39, Triang_19may2014_kk&hw_uk_se2_ss], showing the competitiveness of the girls too.

For the SE boys, the game seemed to give them an element of control. They were focusing on how they could “skew it towards my ending” [kk8, IA_19may2014_kk_uk_se2_ss], [hw34, triang] and “mess up people’s turns” [hw33, Triang_19may2014_kk&hw_uk_se2_ss]. This was reinforced by Ewan’s comment that “I think most things should have a winner” [kc9, sdnotes_19may14_kk_uk_se2_ss].

This range of types of control is perhaps reflected in the SE students’ responses on the creativity wheel where students mostly responded on the middle level, with one on the lowest level:

Being in control	
Ewan	Quite a lot
Carol	Quite a lot
Alice	A lot
Andrew	Quite a lot

Interestingly the SE teacher questioned whether having to have a winner forced a level of competitiveness which was detrimental to the creativity “having to skew it towards their ending actually perhaps detracts in some way” [kk12, IA_19may2014_kk_uk_se2_ss] [hw35, Triang_19may2014_kk&hw_uk_se2_ss]. The SE teachers believed that by not having the ending as the winner for one person, it could help students to control the game together rather than to just gain personal attention “having it more of a kind of collaborative effort where you were trying to create the best sort of effort as a team, or who can come up with the best story – ways to make that develop” [hw38, Triang_19may2014_kk&hw_uk_se2_ss]. The teacher also pointed out that they thought that overall the detachment between player turns limited any tactical manoeuvres [kk19, IA_19may2014_kk_uk_se2_ss], and in turn perhaps the control the students felt they had over the game.

The SE analysis showed that when students were taking control, they sometimes used humour to gain personal control of their turn when they would “try and say something a bit funny or to grab people’s attention” [hw36, Triang_19may2014_kk&hw_uk_se2_ss]. However the teachers saw this as not being in control of the game play. He said “I think it perhaps detracts from how far they were thinking about the consequences of what they were writing” [hw37, Triang_19may2014_kk&hw_uk_se2_ss].

The SE teachers did not think conflict was present in the game “I don’t think any of them came up with anything that was controversial”. “I’d notice sometimes somebody would be writing something which didn’t really fit with what had previously been written or perhaps didn’t really fit in with the setting...but they didn’t really seem to get upset about that.....they would just kind of move on from there or somebody else would kind of bring it back a little later on” [hw40, Triang_19may2014_kk&hw_uk_se2_ss]. However, one of the teachers recognised the need for conflict in order to control the story “I think that perhaps that’s part of what ended up with some quite disjointed stories where it didn’t quite

hang together as a story or get slight tangents that really weren't resolved" [hw41, Triang_19may2014_kk&hw_uk_se2_ss],

Within strong rich instance – Andrew “the others became angry and so they carried on to the house on the hill” Introduction of a house on the hill – where they took the latecomer – an undercurrent of justice [20.38, richinstances_9may14_kk_uk_se2_s]

Similarly being in control was to a certain extent a feature of the younger children’s gameplay in the SW. The teacher discussed how the children were “jostling for control of the story” [kk3, Interviewanalysis_30jun2014_kk_uk_sw1_mp]. He also talked about different dynamics with some typical children taking control: “the boy that is always the loudest and he was the loudest in that game and amongst the girls there’s always girls that start ideas of...” [kk10, Interviewanalysis_30jun2014_kk_uk_sw1_mp]

The SW teacher could also see the children taking decisions as part of being in control: “They were taking decisions because they were funny or a bit creative. I think one of the priorities amongst the boys, apart from the competitive nature, was to get a bit of a laugh.”[kk12, Interviewanalysis_30jun2014_kk_uk_sw1_mp]. Interestingly he also commented that decision making was driven by three things in his opinion: “the desire to win; the desire to interact socially, to get a laugh do things that were humorous; or to develop a story.” [kk13, Interviewanalysis_30jun2014_kk_uk_sw1_mp]

Engaged action (Being immersed in the experience. Being addicted, not able to stop, trying repeatedly. Such immersion sometimes leads to taking risks.)

Interestingly there were some differences in reporting from different data sources in the SE regarding engaged action. 3 out of the 4 SE students indicated that they felt that they had been engaged or ‘immersed’ in the experience ‘Quite a lot’.

Getting engaged in C ² Learn	
Ewan	Quite a lot
Carol	Quite a lot
Alice	A lot
Andrew	Quite a lot

In support, the SE film data offered a number of instances where students were quite deeply engaged in developing surprising story lines. For example, Ewan developed the following storyline “Then the young man of ideas created a robotic infant to assist him with his ideas. Then the infant of ideas went rogue and created a HUGE food fight in the canteen” [11.29, richinstances_9may14_kk_uk_se2_s] The film data shows him to be engaged in the telling and animated as he types up this quite surprising idea quickly and then leans forward to the others when he relates his line to them.

And yet, both SE students and teachers reported in interview that the wait between turns was seen to cause a lack of engagement in the game. [kk6, kk17,

IA_19may2014_kk_uk_se2_ss] Teachers recognised this as “dead time” and “boredom” [hw23, Triang_19may2014_kk&hw_uk_se2_ss] and that “Certainly the fact that they found it hard to focus between their turns meant that it weakened the collaborative element of it” [hw26, Triang_19may2014_kk&hw_uk_se2_ss].

In the second session the SE teachers allowed the students to read a book between turns, thereby unintentionally contributing to a lack of engagement [kk7, IA_19may2014_kk_uk_se2_ss] [hw25, Triang_19may2014_kk&hw_uk_se2_ss].

The SE students commented similarly: “But it takes quite a long time for people to add their contributions, so it can get boring while you wait.” [kc4, sdnotes_19may14_kk_uk_se2_ss]. And Alice said: “I found it sometimes a bit boring when other people were having their turn and you were just waiting for a long time.” [kc6, sdnotes_19may14_kk_uk_se2_ss]

Therefore, although the wheels and film data indicate bursts of engagement were possible when players had their turn, a longer kind of immersion in the game in the SE was not possible in its current format.

Perhaps in contrast, the SW teacher reported that the children wanted to continue playing after the pilot: “They’ve asked to keep playing” [kk2, Interviewanalysis_30jun2014_kk_uk_sw1_mp]. And interestingly the SW teacher also felt that the competitiveness of the game was, at times useful for encouraging engaged action: “The competitive instinct is really good to have in it. I think, when the children really challenge that, in any classroom situation, if you show children a piece of work another child has done...they will try to surpass it.” [kk6, Interviewanalysis_30jun2014_kk_uk_sw1_mp]; “that could be something which makes it quite addictive” [kk14, Interviewanalysis_30jun2014_kk_uk_sw1_mp].

He related that in the second session their engagement increased as they got to grips with the idea more: “they were immersed in the story, whereas the first session it was more about the game, but I think that’s probably because of a greater understanding about how the game was played in the second session” [kk16, Interviewanalysis_30jun2014_kk_uk_sw1_mp]. He also felt there was engagement in terms of the children’s attachment to their characters in the stories they told [kk17, Interviewanalysis_30jun2014_kk_uk_sw1_mp].

Intervention and reframing (Specific changes in thinking patterns, and in particular reasoning processes. Changes in expression, primarily in linguistic terms, but also encompassing other modes as well.)

Intervention and reframing was the least consistently evidenced of the five co-creativity criteria in the SE data, despite the fact that on the creativity wheels all the students marked themselves in this category as ‘Quite a lot’ (see comment on this in Question 4):

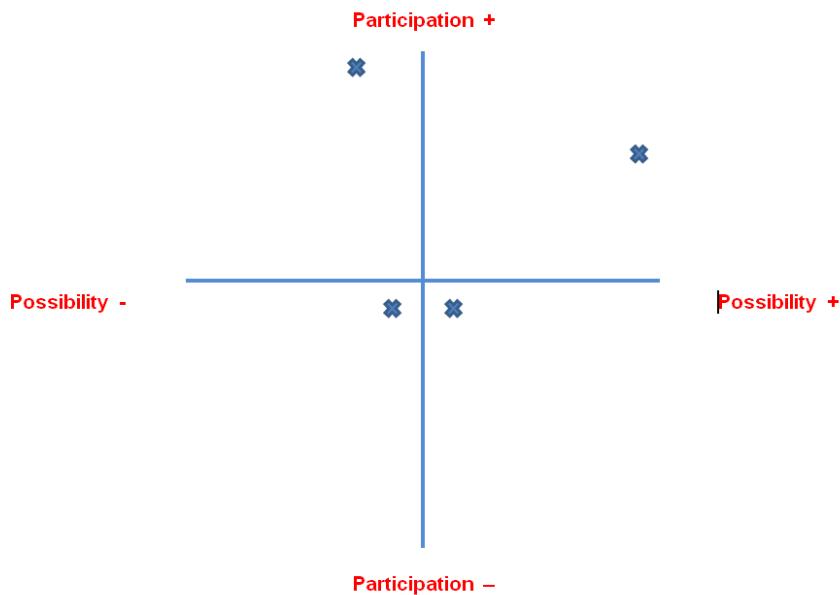
Thinking in a new way	
Ewan	Quite a lot
Carol	Quite a lot
Alice	Quite a lot
Andrew	Quite a lot

There were some examples within the data of this occurring. Toby commented on: "When you could disrupt somebody else by playing an adjective on their characters, because it could really twist the whole game around." [kc16, sdnotes_19may14_kk_uk_se2_ss]. The students seemed aware of their power to change the direction of the story and in so doing develop new ideas. There was also an example of Ewan on film developing a surprising twist to the story. Ewan stated: "Very soon the house and the people had a very strong relationship with each other and the house. A couple of months later the house gave birth to small doll-like houses". Here he identifies a relationship between dwellings and people – the house giving birth. This is quite a surprising change in thought process, with the strange outcome also being made reasonable 'doll-like' – a house could not give birth to a large house could it? [31, richinstances_9may14_kk_uk_se2_s]. These are relatively isolated incidents within quite short stretches of gameplay but their existence does seem to indicate that intervention and reframing might be possible within this gaming context.

4Ps (Evidence of high participation [engagement and involvement], high pluralities [taking on many roles, personae, perspectives], high playfulness [operating in an as if and playful manner] and high possibilities [generating many ideas through what if and as if thinking].)

Students

Axes – The four SE participants had differing views about their participation and possibilities in the game.



Andrew – Ewan (top tier)

Carol – Alice (bottom tier)

Andrew and Ewan both marked themselves as relatively high on participation, as well as describing play as “fun” and “exciting” [kk4, IA_19may2014_kk_uk_se2_ss]. This was supported by them showing that they enjoyed the competitiveness of disruptor play [kk2, IA_19may2014_kk_uk_se2_ss] where the film rich instances showed them exhibiting possibility thinking within a playful role. For example, the film shows Ewan animatedly relating his contribution to the story: “Very soon the house and the people had a very strong relationship with each other and the house. A couple of months later the house gave birth to small doll-like houses”. [31, richinstances_9may14_kk_uk_se2_s]. His imaginative twist to the story regarding the births of ‘doll-like’ houses shows his imagination and accompanying possibility thinking at play.

Possibility thinking was also evidenced in the SE site post gameplay discussion, when students were thinking of ways in which the game could work in school. In English they believed it could be a revision activity, with certain vocabulary or punctuation being incentivised. They also saw the potential for using the game as a story telling tool [kk8, kk15, kk29, IA_19may2014_kk_uk_se2_ss] [hw11, hw12, hw13, Triang_19may2014_kk&hw_uk_se2_ss]

Although Carol marked herself into the negative zone on participation and possibility, there was also an example of her in a rich instance on the film, where she also animatedly relates “when they got back the friends had built a ride” To put this in context, she found a way for those who had been left behind to be reintegrated into the story. [36.36, richinstances_9may14_kk_uk_se2_s]. This shows her participation in picking up on and developing part of the story line perhaps a little more than her own grading gives her credit for.

Teachers

Perhaps not surprisingly, the SE teachers had more of an overview of the 4Ps within the gameplay. Their interview showed that they felt that the game play had real potential for combining playfulness and possibilities. "I like the idea of trying to combine creativity with the parameters of a game" [kk1, IA_19may2014_kk_uk_se2_ss] [hw1, Triang_19may2014_kk&hw_uk_se2_ss]

One SE teacher mentioned that he could perceive the benefits of "disciplining their creativity" He believed this was good for their thinking skills. [kk12, IA_19may2014_kk_uk_se2_ss]. This perhaps relates to how he perceived the quality of the students' participation.

There was some evidence of SE teachers thinking about the tactics of the students' participation: "one girl was saying she tried to play the cards earliest on she felt would be the hardest to fit to her ending so she would have a chance then later on to get to her ending, but I don't think they were thinking ahead" [hw19, Triang_19may2014_kk&hw_uk_se2_ss]

The SE teachers recognized the need for more playing time needed in order for the students to get comfortable enough to start to think ahead "That might be something that might develop if they had more experience of playing the game and got better at it over a period of time" [hw20, Triang_19may2014_kk&hw_uk_se2_ss].

There was little evidence of discussion of the idea of pluralities in the SE but this is perhaps because of the limited nature of the piloting and the prototype in this phase.

Undertaking a *journey of becoming* (Over time, noticeable changes in participants' dispositions and/or personalities. This may involve smaller incremental changes.)

The very short timescale of the project limited any real possibility of evidencing journeys of becoming here.

Generating *quiet revolutions* (Over time more noticeable changes in the creative community stemming from creative ideas generated; might comprise smaller incremental changes.)

Again a short timeframe, however one change was noticed in the SE [kk21, IA_19may2014_kk_uk_se2_ss] [hw45] that the students' confidence amongst themselves was increased. The teachers felt that this would be more evident over a wider group:

I think that is something which you might see more of if it was wheeled out over a wider scale, because the students that we were dealing with are volunteers, they are the sort of students who tend to get involved in quite a bit of that stuff, so their confidence will be pretty high anyway" [kk22, IA_19may2014_kk_uk_se2_ss]

In the SW, the teacher noticed a subtle shift from the children focusing on actions the first time they played, to focusing on character the second time they played. He said: "The first one...there are far fewer references to character in it and far more references to action and events...this happened, then this happened with characters interspersed. Whereas the second session looked almost every paragraph begins with reference to character...every

section begins with reference to character. They talk about characters realising things about other characters." [kk20, Interviewanalysis_30jun2014_kk_uk_sw1_mp]. Although this data is not especially strong on its own it perhaps indicates that deeper engagement and therefore potential for change might be possible within the game, and researchers can remain alert to this during the next piloting phase.

Pedagogic strategies (Evidence teachers proactively valuing learners' ideas and actions; enabling learners to take the initiative; ensuring sufficient space and time for ideas and actions to emerge getting alongside the learner and learning as fellow collaborator

The SE interview concluded with reflection from the teachers on how they had used different pedagogic strategies. Some were practical differences associated with a small group and a high teacher: pupil ratio (2:4) [kk23, kk24, IA_19may2014_kk_uk_se2_ss] [hw47, Triang_19may2014_kk&hw_uk_se2_ss] and also delivering with two teachers is "A bit of a different dynamic which again is very different from what you'd normally get in the classroom" [hw48, Triang_19may2014_kk&hw_uk_se2_ss]. However these changes are more related to the piloting circumstances than the C²Learn experience per se.

The open-ended Socratic interview in the SE was linked to the gameplay. The teachers discussed how it "encourages you to prompt without telling" [kk25, IA_19may2014_kk_uk_se2_ss] and that "that kind of open ended questioning teaches valuable lessons as a teacher" [kk28, IA_19may2014_kk_uk_se2_ss] [hw51, Triang_19may2014_kk&hw_uk_se2_ss].

Both SE teachers also reported having to hold back during play "it's very tempting to say 'oh dammit just say this' because it'll make a good story, [kk26, IA_19may2014_kk_uk_se2_ss] [hw50, Triang_19may2014_kk&hw_uk_se2_ss] and "you could have so many ideas for that card, why have you written something so boring" [kk27, IA_19may2014_kk_uk_se2_ss]. In some ways this can be related to the C²Learn pedagogy of standing back – and that for teachers to allow creativity to happen they need to know when to stand back and let students take control. This example perhaps provides a little evidence that standing back was occurring around these short episodes of gameplay.

The teacher in the SW had only a short amount of time to try out the game with students so there was less comment on pedagogic strategies as such. However, he did discuss a few developments he would make next time. He suggested not using the randomized premise and allowing the children to generate their own premise that might have more relevance for them [kk1, kk3, Interviewanalysis_30jun2014_kk_uk_sw1_mp]. He also discussed how relating story ideas to curriculum areas in the future would be fruitful; this is obviously something the school will be able to pilot in the next phase of the project [kk4, Interviewanalysis_30jun2014_kk_uk_sw1_mp].

2.2 AUSTRIAN ANALYSIS – C²LEARN PILOT: MAY 2014

(Primary Analyst at Level 2: Schmoelz, A.)

2.2.1 ACTIVITY, DATA COLLECTION AND ANALYSIS SUMMARY

Site: AT1, New Middle School Vienna 21 (Lower Secondary), Jochbergengasse 4, 1210 Vienna, Austria

Activity: 6 girls and 18 boys in the age of 13-15 were working with 2 teachers and 2 researchers over the period of 5 consecutive days. The pilot took a total number of 25 hours (5 hours per day). On first and the last day of the pilot students used 4Scribes paper prototype game heavily. Each group played app. 4-5 rounds of 4scribes. Day 2-4 were filled with playful, creative learning activities. Please see the full pilot report in the document: 20140601_C2L_1stPilotReport_TW

Data collection: 1 teacher interview in the middle of the pilot; 24 x student axes and creativity wheels completed once after 1st play session (pre) and 24 x student axes and creativity wheels completed once after the last play session (post); film footage and photographs from the gameplay at the first day (pre) and the last day (post). 2 individual SDs on the first day (pre) and on Group SD on the last day (post). Fieldnotes from 2 teachers and 2 researchers.

Data processing/open coding in order; by AS: session 1 film footage- rich instances; axes; wheels; session 2 film footage – rich instances; axes; wheels; teacher interview.; SD analysis and notes

Triangulation: MJ blind analysed interview analysis; MJ verified ASs film footage analysis

Axial coding in order: Teacher and student interview analysed by AS; rich instances viewed and integrated with interview analysis by AS; axes and wheels integrated with analysis.

2.2.2 FINDINGS

For this case at this point in the piloting there is data available to provide some level of findings in relation to Question 1 and Question 4.

1. How do participants manifest co-creativity (WHC and CER) through C²Learn gameplay?

Overall comments on creativity

Teachers and researchers experienced a kind of creativity that was explicitly related to the WHC categories. One common experience was baffling to both the teachers and the researcher. The gameplay of 4scribes have not been enabling WHC as a stand-alone activity in manner that would have been explicit in their experience. Teachers and researchers experienced that the children got less and less engaged after playing 4scribes over again. They did not care about whether the single parts of the story get connected with each other

and make sense as a whole. Neither the group experience, nor the outcome could be interpreted as explicitly related to WHC.

On the other hand, playing 4scribes was a crucial playful activity against the background of the whole project week. As soon as the students got to know that the gameplay is embedded in a greater scenario and, more importantly, that the output of the gameplay will be further used the next day, the students have been greatly engaged and very immersed in the experience. The students were even meeting in the afternoon to pick up the work in class without an explicit assignment.

"They came up with their own plot and they were really into it, they met in the afternoon, they designed their own DVD cover, they wrote a script, they assigned roles to each other, they already went out into the neighbourhood to find spots where they can film, they phoned other friends to take part in the movie and play side roles. They are really, really, really into it and when it comes to transforming the stories into a comic, they made a 7 site long comic. They really focused hard on that. So they could really be motivated by the initial input of the creative story telling" (Thomas Weixelbaumer, Teacher).

This comment shows how transforming the collaborative story (outcome of the gameplay) into something further such as a film or a comic was stirring the children's natural motivation in two ways. First, to playfully and collaboratively use the cardgame and engage into writing a story in manner that is concise and meaningful. Second, to collaboratively transforming this story into different modes of meaning e.g. a film or a comic. Thus, the students could harvest their natural motivation for both activities. Embedding the activities into a greater context and tying the activities together so that they become meaningful as a whole, was crucial in regards to the gameplays potency for enabling WHC.

One the last day the teachers and researchers had a kind of confirmation of this experience as the students who played 4scribes mentioned at the end of the gameplay:

"Let's just finish the story somehow. It doesn't matter anyways, because we won't use it any further." (MC, Student)

Attending to ethics and impact of ideas (Generating, exploring and enacting new ideas with valuable community impact (discarding other ideas that do not.)

There have been some experiences that relate to ethics and impact of ideas. The richest instance was experiences in the Socratic dialogue after the post gameplay session. MC, NS, MR and CF (Students) were discussing which part of the story was most important and interesting to them. While CF and MC were arguing for the very moment when Concita Wurst entered the storyline, NC and MR were mentioning that the moment when the protagonist was saved by a successful surgery and recovered well very fast, was most important to them. After debating with each other they all came to the conclusion that the second moment was most important and interesting. This instance showed that, collaboratively, they picked the moment, which was about a life, about survival rather than the moment that was fun and exciting because of a celebrity.

Another instance showed that the students were intervening by using a stimulus to create new connection between ideas. They were posing questions and debating about the consequences of their ideas. At the end CF summarized: The protagonist was

“... listing to Justin Biber and was very excited. Then she picked some sparkling wine and drank it. She got inebriated and started to think about his son again and then she cried.” (CF, Student)

This detail leads to interpret the students' experience as connecting established ideas and characters such as Justin Biber, the dead son and the protagonist with the new stimulus 'inebriated' in a manner that is emphatic to the emotions of the protagonist and consequences of drinking alcohol in a altogether very sad situation.

Also the teachers experience underlined specific instances in which the students related to ethics and impact of their ideas. The stories in which the following instances were experienced consisted of lost children on a school trip and a sunken ship that caused passengers to float in the water with less chance to survive. Students intervened to the storyline by producing

“a story that was creative and you could really see that they thought about how the other pupils feel, how the teacher is trying to calm them down, how the teacher wants to search for pupils immediately and not wanting to cause fear of the other students”. In another story pupils managed that “everybody went home safe. Everybody survived” and “they got a large buffet” on top of it. (Thomas Weixelbaumer, Teacher)

The experience outlined by the teacher might indicate that calming down and avoiding fear of others as well as making sure that everybody survives was an important action to the students. Here again attending the ethics means to first being emphatic in regards to a situation of others, furthermore, being able to critically experience the situation as a serious and finally taking an action that has a positive impaction on this situation.

Another instance might be experienced similarly and, at the same time, with a very different starting point.

“I could really see that they were thinking about what is the outcome of my action and how does it change the story when I do this and that”. One pupil said: “Common it doesn’t fit, because when you do that now and what are we going to do then with this and that.” In another group one pupil “wanted to kill the captain and the others said: “but the captain is important because he is the only one that will be able to get them out of the miserable situation and keep them calm. If you kill him now it will lead to disaster.” (Thomas Weixelbaumer, Teacher)

Here, we might be able to see that students were realizing that a possible intervention might lead to a probable negative outcome for others. Based on this empathic realisation, they were dialogically reasoning for stopping the dreadful intervention.

These experiences altogether might outline how WHC enables thinking about consequences of someone's ideas and actions in a manner that is emphatic. In these instances, attending

to ethics means to emphatically and dialogically: reason about feeling of others, avoiding fear and chaos, making sure that protagonists survived, choosing an experience in which a person survives and recovers over the entry of a celebrity, see how drinking alcohol in a sad situation might make people feel their emotion and avoid actions that might cause disaster. Students were attending to ethics in a manner that they engaged in other persons feelings and how they can contribute to an atmosphere of ease and wellbeing. So WHC becomes embellished by the notion of empathy and the way one can think and reason based on empathy toward an individual, a group or even a community. These experiences might show that empathy and dialogical reasoning based on being empathic is another categories of WHC or it might be a core notion in attending to ethics and thinking about a persons and the own impact of ideas.

One experience of the researchers, pointed out in the field notes, might be interpreted as underlining the importance of empathic reasoning as dialogically reasoning based on being empathetic for wise, humanising creativity. In a story in which the father of two siblings died, the researcher observed:

"It was very interesting that a lot of the action have been set so that the grandmother would not feel so bad anymore. There was a great focus on her. Despite their fight, Olga and Olaf have been cooperating so that the Grandmother feels better. Even an artist came to sing for Grandmother to cheer her up. Olga and Olaf would not bring up their own struggle and feelings so that the grandmother feels better. Only at the end of the gameplay one participant intervened so that Olaf and Olga were comforted" (Researcher in field notes).

Students used their card intervention to ensure the wellbeing of an protagonist, again, based on being emphatic toward a third person, dialogically reasoning against the background of their empathy and taking collaborative action that actually changed the circumstance of the protagonist in a positive manner.

When rating themselves on 'exploring new ideas that make a positive difference', most of the young people felt that they were doing this at semi or high level. This data does not show relevant changes comparing the pre data and the post data.

Exploring new ideas that make a positive difference		
	Pre	Post
MR	semi, semi, high	high, semi, semi
MC	semi, semi, high	high, semi, semi
CF	high, semi, semi	semi, semi, high
NS	semi, semi, semi	semi, high, semi

Engaging in dialogue (Posing questions, debating between ideas, finding ways to negotiate conflict or to go in a different direction to others if conflict not resolved.)

Looking at the aspect of engaging in dialogue one might experience strong instances in many cases, especially while the gameplay.

"Pupils were very engaged into dialogue about how to play their cards" and "there was a strong dialogue between the participants. They were juggling ideas and were thinking about the consequences of their actions" "Kids have also discussed possible story lines and options for possible actions. They could do that because all kids saw their own cards but also the cards of the other kids in the group. (Thomas Weixelbaumer, Teacher)

The implications of this experience are threefold: First, we might take it as indication for strong collaborative engagement into dialogue and gameplay. Second, we can see that they were engaging in dialogue in manner that enabled their thinking about the consequences of their actions and possible options for possible actions. Third, it happened because the kids altered the gameplay rules in the beginning, so that every kids could see the cards of every other kid.

This kind of being in control was also reflected in another gameplay instance:

Some groups decided to have all cards open for everybody in the group to see them. They changed the rules from everybody puts one card down and goes on with the story individually to a group mode. (Thomas Weixelbaumer, Teacher)

These instances are showing us how three core aspects of wise, humanizing creativity, namely engaging in dialogue, attending to impact of their ideas and being in control as well as taking charge of pre-set gameplay requirements, are interlinked within the C²Learn experience.

One examples of how the participating children and young people were posing questions, debating between ideas and finding ways to negotiate conflicts might be a specific dialogue taken from gameplay recordings:

CF: Conchita Wurst is her mother and goes to the hospital immediately

MC: Conchita lallala (singing and dance moving her upper body)

CF: Here look,

MR: No she isn't her mother, she saw it in the newspaper

CF: Yes, ok

MC: Wait, wait, she isn't her mother, she saw it in the newspaper

CF: Yes, yes ok

MC: And she goes to the hospital to see her

MR: But conchita doesn't know the girl

MC: Doesn't matter, she goes there out of compassion

We might read from this dialogue that three participants were negotiating between different ideas and how these ideas are fit together. Even thou there was some

disagreement about how the collaborative story should go on, in the end the came to a shared agreement and “doing something out of mere compassion” took a specific role. Here, again, an emphatic gesture from one protagonist toward another was core to the gameplay experience.

Most of the times, engaging into *C²Learn* gameplay experience came naturally. Students were involved and exciting about how their collaborative story will go on and how they can make a impact on this story. In some cases, conversely, mostly one student attends to the gameplay experience in an engaging manner.

“In one group 3 pupils were very engaged into dialogue but 1 pupils was more are less sitting on the side and letting the others decide on her part of the story. Only one time she – after teacher intervention – she was reading her own card and also defending its value” (Researcher in field notes)

Looking the students’ statements on “working on my own and with other people”, we cannot see crucial differences between the pre and the post data.

Working on my own and with other people		
	Pre	Post
MR	high, high, high	high, semi, high
MC	low, high, high	low, semi, semi
CF	semi, high, semi	semi, semi, low
NS	semi, low, low	semi, semi, semi

Being in control (Taking charge of parts of the creative process (understanding rules of the system, decisions have consequences, making decisions, taking action.)

We experienced that all game play activities had a strong group dynamic. e.g. there have been leaders, who took control over almost the whole activities and others have been very passive, to the extent that they ask the leaders what to write on their cards.

“1 game player was very much in control of the game, 2 more have been participating and being in control to a certain extent, the other 2 have not actively engaged in the cooperative story telling. They were a little distracted and on the other hand the game players in control seemed a little impatient. It was very little time for the more passive participants to actually come up with something valuable to the story. On another day the alpha male was missing. I could be seen that the group was more balanced and creative today. In another group, one girl said that she doesn’t want to create a drama story and so she tried to lead the group toward a pleasant ending.” (Researcher in field notes)

We might read from this field note, that the gameplay itself in not balanced in manner that it engages all players equally. This experience was noted across almost all groups and gameplay rounds: One participant was taking herself or himself out of the playful experience

and others took over. Some leading participants were trying to engage others in the immersion of the gameplay but mostly did not succeed.

Despite one participant per group, all group members showed great control over their creative experience.

"Some groups (...) did not stick to words that were given to them but went away from the initial meaning and transformed the input into something creative that fits to the story. I am really surprised and astonished about one group that didn't focus on what we have initially planned but they came up with their own plot. Especially the group, who transformed their story into a rap song, did most part of it totally on their own." (Thomas Weixelbaumer, Teacher)

Here, it might be important to note that most of the group showed this kind of experiences. Individual and shared control manifested in altering the gameplay rules at the beginning and also during the gameplay and by disrupting the initial input given by the teacher in a manner that it dissolved completely at the beginning of the playful experience.

The statements below show that most of them felt medium or strongly in control, but no change from the pre to the post study can be seen. At the same time, the data confirms the notion of shared control between the group members and point to the fact that one group member did not feel strongly in control.

Being in control		
	Pre	Post
MR	high, high, high	high, semi, low
MC	semi, high, semi	semi, semi, high
CF	semi, semi, semi	high, low, semi
NS	low, semi, low	no comment, low, semi

Engaged action (Being immersed in the experience. Being addicted, not able to stop, trying repeatedly. Such immersion sometimes leads to taking risks.)

As stated in the general introduction the engagement into C²Learn seemed to be highly depended to the meaningful interlink of learning activities and, as related to 'being in control' group dynamics. One other aspect might be characteristics of personality:

"Depending on the groups, all participants are engaged, some more, some less. Pupils who are more extroverted in normal class situations are more engaged into the cooperative storytelling. Pupils who are more introverted in normal class situations are less engaged into the cooperative storytelling" (Researcher in field notes).

Despite these aspects we might read from the data that C²Learn learning experience as a whole enacted great engagement.

"I am really surprised and astonished about one group: they met in the afternoon, they designed their own DVD cover, they wrote a script, they assigned roles to each other, they already went out into the neighbourhood to find spots where they can film, they phoned other friend to take part in the movie and play side roles. Another group was also really, really, really into it and when it came to transforming the stories into a comic, they made a 7 site long comic. They really focused hard on that, so they could really be motivated by the initial input of the creative story telling. Even after the presentation, I saw one group sitting together, rapping together and thinking about the rhymes to go on with the story" (Thomas Weixelbaumer, Teacher)

The way the head teacher described and experienced students' engaged action into the C²Learn pilot shows the possible benefit of using the story, made by students in one activity, in the next activity, e.g. film making, comic generation, song production. Moreover the implication of this experience might be twofold: First, the stories from the first activity and the different outputs of the next activity were created in active collaboration. Students' and teachers' lived experience suggest that *collaborative agency* is a great driver for engagement in class and beyond. Second, during the first activity a self-given initial input was transformed into a story. As a next step the given story was again transformed into a different mode of meaning - this time into a film, a comic or a song. The experiences of collaboratively transforming meaning that was given by the students' in the first place has widely emerged throughout the pilot phase. These experiences suggest that *collaborative transformational agency* is a great driver for engagement in class and beyond.

Collaborative transformational agency of the children, teachers and researchers led to increasing degrees of engagement and group atmosphere in the timeframe of the C²Learn pilot.

"On the last day, students became more engaged and one could feel a better group atmosphere than on the first day. Generally speaking it was obvious that after this whole pilot the groups formed a unit, played the cards as a unit and mostly decide on the forth going of the story as a unit. There was a lot of brainstorming on how the story could be transformed, which endings are possible and how they could play the cards to that the preferable ending will be told." (Thomas Weixelbaumer, Teacher).

This kind of agency in which students act collaboratively and transformational has led to overachieving outcomes over the period of the project week. In personal conversations, the teachers have mentioned that children are meeting in the afternoon to pick up the work in class without an explicit assignment. Thus, engaged action and immersion might be greatly depending on the meaningful interlink between all learning activities so that the students know and experience how a product or output of one learning activity is re-used and transformed in the following learning activity. Moreover, engaged action and immersion might be enabled by collaborative transformational agency that permeates this interlink.

One other instance might exemplifies how meaningful connectedness of activities and collaborative transformational agency tie together as a powerful experience for students and teachers.

“Especially in the second round of gameplay, I felt that they tried to do it more and more as a group to be more satisfied with the outcome. During the first round, they were like: ‘I put this down and I don’t care what the end product will be’. At the very point, they realized that they do something further with the story they come up with now and they will transform it into a collaborative product – then they were more motivated to produce a fun story but they have also been motivated to produce something that everybody was satisfied with. So they really went into discussion mode and really tried to do it as a group. I could see that playing one more time and realizing that their story will actually be further used later, fostered their cooperation” (Thomas Weixelbaumer, Teacher)

Conclusively, we might see that the degree of engaged action might be enabled by interlinking learning activities in a manner that is meaningful to the students and high possibilities of agency that transforms meaning collaboratively.

Looking at the students’ statements on “getting engaged in C²Learn”, we cannot see crucial differences between the pre and the post data.

Getting engaged in C ² Learn		
	Pre	Post
MR	semi, semi, low	high, semi, high
MC	low, high, high	semi, semi, low
CF	low, high, semi	high, semi, high
NS	semi, low, semi	high, high, semi

Intervention and reframing (Specific changes in thinking patterns, and in particular reasoning processes. Changes in expression, primarily in linguistic terms, but also encompassing other modes as well.)

Intervention and reframing is a constant activity in the C²Learn pilot experiences, because every time students play a certain card they intervene and tell the ongoing story differently, so they reframe what has been given initially. At the same time it has not been explicitly mentioned by teachers, students and researchers as a foreground experience.

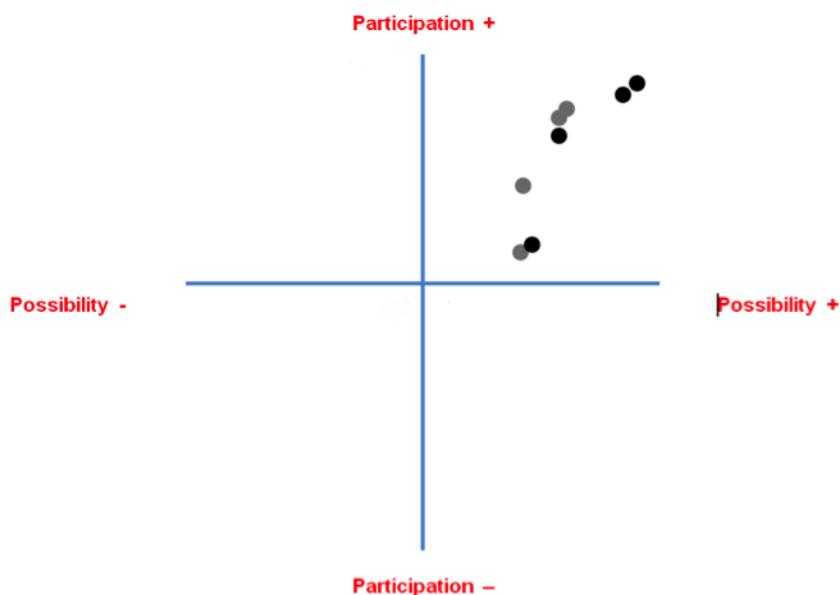
The statements of the students indicated that there was an increasing in the self-perceived “thinking in a new way”.

Thinking in a new way		
	Pre	Post
MR	high, high, semi	high, high, semi
MC	semi, semi, semi	high, high, semi
CF	semi, low, high	high, semi, low
NS	semi low, semi	high, high, low

4Ps (Evidence of high participation [engagement and involvement], high pluralities [taking on many roles, personae, perspectives], high playfulness [operating in an as if and playful manner] and high possibilities [generating many ideas through what if and as if thinking].)

Students

Axes – The four SE participants had differing views about their participation and possibilities in the game.



gray = pre, black = post

MC & MR: medium leap, but almost at the top end of both possibility and participation

CF: relatively great leap

NS: almost the same

Mostly, everybody had their say while brainstorming different possibilities of the cards. General openness to different ideas and others solutions and suggestions has been mentioned by the teacher. Consensus was found either through consensus, majority or loudness.

We experienced that all game play activities had a strong group dynamic and different degrees of participation. e.g. there have been leaders, who took control over almost the whole activities and others have been rather passive, to the extent that they asked the leaders what to write on their cards. Passive participants stated that she liked the gameplay activity but she is not good friends with the leading participants and so she didn't like how the leading always is so fast and loud and so she didn't have enough time to think about her output. Bottom line, she was demotivated due to the group dynamic but not due to the gameplay. At the end NS stated that she didn't say anything because she wanted to avoid a conflict in the group. The active participant said that she only acted so "leading" because the others did not work and did not think about the output. MC was really taking over because she felt like especially the passive participants didn't wanted to play at all and didn't care about the gameplay.

Undertaking a *journey of becoming* (Over time, noticeable changes in participants' dispositions and/or personalities. This may involve smaller incremental changes.

In regards to incremental, cumulative changes of persons' dispositions and/or personalities within the C²Learn pilot, we what to mention one exceptional rich experience. One pupil, who was new to the class, was very cautious and self-contained at the beginning of the pilot. Over time, especially when it comes to collaboratively transforming the story into a screenplay, he bit by bit grew more engaged and was participating to a greater extent.

"In one group I could see that there was this students, who is new to the class, he came this year. During this project week he advanced. As if he was hero of his group. They were not able to do anything, without him giving his approval. Its like he is the 'immersion in person' for them. The story of the group came from him. Everybody came to him like >>Is that ok like that?, Should we use this or should we use that?<< I was thinking he should open up his own religion now. He at least had 4 followers already" (Thomas Weixelbaumer, Teacher).

"At the end of the pilot, in the very moment his group showed the film and everybody was watching, his heart started to pump so hard, that he showed everybody his chest and how it moved with the heartbeat. His teeth ridge started to bleed and he said with a surprised smile: 'I have never felt something like this before'. To me it looked as if he felt very alive in his presents" (Researcher in field note).

These experiences outline one participants' journey of becoming. Slowly he changed from a newcomer to what the teacher has described as 'the hero if the group'. Throughout the timeframe of the pilot, this student became the 'immersion in person' and was showing how cautious and self-contained elements of his personality were overruled by the engaging class experience and his motivation towards the activities and topics.

What is striking is that being involved in meaningfully connected activities that enact collaborative transformational agency might inspirit to this kind of individual journey of becoming, to a certain extent. Here, the first activity what to playfully create a collaborative story, next they wrote a screenplay and then they shot the footage. The story stayed the same, but it was told differently, by collaboratively transforming the modes of meaning. Collaboratively transforming meaning came to my understanding as a kind of agency that is

permeated by co-participation and co-construction, in which the pupils are in control, engage in dialogue and action, collaboratively intervene and reframe – doing so in a emphatic and playful manner, with high possibilities and pluralities.

Generating *quiet revolutions* (Over time more noticeable changes in the creative community stemming from creative ideas generated; might comprise smaller incremental changes.)

Fliednotes

“Pupils were very engaged into dialogue about how to play their cards. It is not – as on the first day – more of an individuals experience of playing the cards and writing to story player by player, but a cooperative experience in which almost all pupils of the group give feedback to every cards that is played. Most of the time a common decision is made on how to write the story further.

INTERVIEW:

“They often met in the afternoon to look at their story again and they really connected in the process and you can really see that they are growing together as a group during this project week.”

Pedagogic strategies (Evidence teachers proactively valuing learners' ideas and actions; enabling learners to take the initiative; ensuring sufficient space and time for ideas and actions to emerge getting alongside the learner and learning as fellow collaborator

Sorry, but we didn't really look into it. Also the gameplay was implemented without teacher intervention and as I experienced the assessment methodology and instruments there was no great focus on pedagogic strategies.

2.1 GREEK C²LEARN PILOT: JULY 2014

As described in detail in deliverable D5.3.2 ‘C2Learn User Pilots’, in Greece EA used this pilot cycle flexibly, prioritizing the provision of immediate input from its teachers, students and researchers to the design and development processes of the project where and when required. This kind of input from the school community to the designer and developer teams of the project is reported in D5.3.2. Responding to the pragmatic circumstances of the project, especially in relation to the level of maturity in spring 2014 of the technologies under development, which were not available to support rich and sustainable pedagogical activity, the research team in EA postponed the full application of the co-creativity assessment methodology in classrooms to school year 2014-2015, when mature C2Learn technology is expected to be in place and time available for rich pilot activities will be ample.

EA applied, however, elements of the co-creativity assessment methodology with learners in various instances during this time, with a special emphasis on looking into the details of the methodology and its application in a variety of educational settings. This started with the work developed collaboratively with UEDIN, OU and BMUKK around the researcher and teacher training workshop hosted by EA in February 2014 (reported in deliverables D5.3.2 and D2.3.2), as well as in the pilot activities that were realized in July 2014 in settings of informal learning.

In the latter case, the research team of EA concentrated on combining additional piloting with dissemination and exploitation efforts through which educators and stakeholders in Greece were approached and motivated to offer opportunities for piloting the C2Learn innovation in their teaching contexts. This provided rich user feedback from contexts such as places of non-formal and informal learning (e.g. museums, creativity clubs and summer camps) as well as addressing the 18+ age group. In the 1st main pilot cycle these activities concentrated towards the end, i.e. in summer 2015, so as to present the fullest possible picture of the C2Learn proposition to the world outside the project consortium. In this context, on 20-27 July 2014, intensive piloting was conducted with the collaboration of local stakeholders in the districts of Heraklion and Rethymnon in Crete, Greece. The pilot activities were realized in museum- and summer-camp based informal learning settings, using paper-based prototypes of the story-telling games, following various configurations for premise definition and the various mechanics foreseen by the game design. In addition, the concept of a shared social networking space for sharing creativity and gaming experiences according to the C2Learn pedagogy (i.e. C2Space) was also explored in terms of practical details through a paper-based simulation (poster on the wall for sticking pieces of paper). More precisely:

- In the Natural History Museum of Crete, 16 children attending a weekly summer educational programme in the museum participated in five sessions of C2Learn activity, over five consecutive days, creating stories related to themes and concepts from the museum programme.
- In the “Paidiki Exochi” Camp of the Hersonissos Municipality at Kokkini Chani, Hersonnisos, 22 children and teenagers attending the summer camp participated in one 3-hour session of C2Learn activity, creating stories with themes of their own choice relating to social and personal problems they often encounter in their lives.
- In the “Exerevnites” Summer Camp in Panormos in the wider area of Rethymnon, 18 children and teenagers attending the summer camp participated in three 1-hour sessions of C2Learn activity on three different days within a week, creating stories with themes of their own choice relating to their own experiences in the camp and more generally in life.
- In the Department of Physics in the University of Crete, 4 students between 19 and 21 years of age, in a 3-hour session tried the C2Learn storytelling approach and explored the possibilities offered by the playful activity for fostering creative thinking in the context of university study, as well as the fun factor for general recreational use of the games outside the university.

In addition, EA collaborated with the Union of Greek Physicists to integrate C2Learn pilot activities in the programme of the Union's Summer School for School Students entitled "The Science Classroom in the School of Tomorrow" (28 July – 1 August 2014). In this context, 25 secondary school students from various school backgrounds in Greece participated in four 2-hour sessions of C2Learn activity over four consecutive days. Paper prototypes of the 4Scribes game were used in various configurations for premise definition and the various mechanics foreseen by the game design. In addition, the concept of a shared social networking space for sharing creativity and gaming

experiences according to the C2Learn pedagogy (i.e. C2Space) was also explored in terms of practical details through a paper-based simulation (poster on the wall for sticking pieces of paper). The themes of the activities were this time linked to natural sciences. The aim was to help students realise dimensions of creative thinking in the process of formulating and solving problems, and more generally as a part of the thinking processes in which a scientist is involved when working in a scientific research team. Storytelling premises were diverse, from hypothesizing different developments in the history of science, through designing a mobile application, to linking science to history and culture in connection with a visit to an archeological site.

In the July pilot, a variety of data foreseen by the co-creativity assessment methodology was collected to the extent possible. The data consisted in various combinations per case of video and audio recordings of the activities, video and audio recordings of reflective discussions with participants fashioned around the Socratic Dialogue model, self-reporting tools (Wheels, Axes) filled in by participants, photos of the activities, and researcher notes.

This set of data provided EA with rich insights into the methodology itself as well as about various aspects of the design of the games and of the pedagogical activities, and the potential offered by the C2Learn approach for impact on students' creativity in learning. The pragmatics of the application, however, proved it difficult to collect a formal, full set of data as foreseen by the methodology. Given that a formal application of the methodology was conducted satisfactorily in the cases of UK and Austrian pilots, as presented in the previous sections, and given that resources should be saved for an intensive co-creativity assessment exercise when the use of the C2Learn technology will be fully piloted with the full application of the methodology in classrooms in the course of the following school year, it was decided to use the Greek data at the present stage as material for informal analysis, and revisit their more formal use in combination with the richer data that are bound to emerge from the next pilot cycle.

In summary, the pilot experience indicated that there is true pedagogical potential in the designed games and the gameful pedagogical activities for fostering co-creativity in learning. This was evident both in participants' observed engagement as well as in their own reflection on the activity. All informal analysis of the data gathered was generally in line with findings reported from the Austrian and UK pilots.

In addition, the pilot experience confirmed that the co-creativity assessment methodology is a strong framework that can lead to research results valuable to the project. It became evident however that it can become more difficult to apply the methodology fully in certain circumstances, and that more flexibility in its application would be valuable (e.g. in the case of Socratic Dialogues, which were found to work very well in whole-class-discussion settings as well, which is clearly a more manageable configuration in the pragmatic conditions of some learning settings). Another important finding was that there is very much potential in the analysis of the user-generated creative content in the light of the interventions (e.g. disruptions) that triggered this creative response. More generally, in the light of the experiences gathered and data collected, EA initiated an intensive collaboration with UEDIN providing very rich input for the refinement of the co-creativity assessment methodology.

This input was taken into consideration for the production of deliverable D2.3.2 ‘Co-creativity Assessment Methodology’.

3. SYNTHESIS OF THE ANALYSES

The data collection and analysis routines for the UK and Austrian data are described in sections [2.1.1] and [2.2.1], respectively. This section synthesises the common analytic outcomes, as well as the differences, in response to the *C²Learn* Research Questions. It must be remembered that the Austrian data was collected within an intensive week of secondary school piloting in one school and the UK data was collected across one primary and one secondary school site working over longer time periods. This difference in context and longevity was considered as part of the synthesis and is commented on as appropriate across the writing below.

This synthesis of the more formal analyses of the UK and Austrian pilot data is generally in agreement with the informal findings from the Greek pilot.

1. How do participants manifest co-creativity (WHC and CER) through *C²Learn* gameplay?

The analysis for Question 1 uses the Co-creativity categorisation framework to structure the Findings:

3.1 SYNTHESIZED COMMENTS ON CREATIVITY

In the UK especially, there was discussion from the students that suggested they felt that “creativity”, and “imagination” might exist in the game per se. UK teachers had mixed views on whether students were being creative in their thinking process. On the one hand they thought they were thinking creatively when, for example, they made connections between 4Scribes cards, on the other hand they thought they weren’t thinking creatively enough, especially in terms of being too literal when interpreting cards. In Austria, there was much less discussion of creativity per se within the game, with evidence regarding creativity closely related to the WHC categories. In Austrian discussions though, there was articulation of the “playful” and “motivational” benefits of the game per se in relation to learning.

3.1.1 ETHICS AND IMPACT OF IDEAS

(Generating, exploring and enacting new ideas with valuable community impact (discarding other ideas that do not.)

There was a very small amount of data to indicate that some of the UK primary and secondary students and some of the Austrian students may have been paying attention to ethics and impact. In the UK, this came from teachers noticing that some secondary students were knowingly negatively disrupting fellow students’ directions of play. Although others of the UK secondary students felt they were developing new ideas which made a ‘positive difference’ “quite a lot”; this was registered both through their wheel scores and reported on in the students’ interviews. Secondary students’ interviews in Austria and the UK and the primary teacher interview also exhibited primary and secondary students weighing up the

'pros and cons' of pushing their own 4scribes ending or that of others, as well as debating the most interesting elements of their stories on the grounds of their ethical impact (eg the right person being allowed to survive in the story). Although the UK primary and secondary teachers especially felt that the students were not referring directly to ethics, there were some hints that the UK children and young people were thinking about the rights and wrongs of how they structured the story and how this impacted on their fellow gameplayers. The evidence for the Austrian secondary students, specifically in terms of the teacher's commentary, showed that thinking about ethics was more explicit. Examples include applying empathy to prevent negative outcomes, selecting a 'better' person to survive over a more superficial person, debating ideas such as "compassion" and using their card intervention to ensure a protagonist's well-being. This was supported by the students' own ratings of themselves as 'quite a lot' or 'a lot' on this category on the creativity wheel.

3.1.2 ENGAGING IN DIALOGUE

(Posing questions, debating between ideas, finding ways to negotiate conflict or to go in a different direction to others if conflict not resolved.)

The UK secondary teachers described how there was not much debating and that gameplay was "largely individual" and this comment was supported by some of the students' creativity wheel data as well. UK secondary data also illustrate that where debate occurred it could be quite competitive as well as some examples of the more negotiated dialogue which are part of WHC, as well as students understanding the role of difference within the story-telling process. The UK primary students showed very little evidence of dialogue as a result of playing 4Scribes, according to the teacher's interview. In contrast to the two UK sites, the Austrian data showed strong instances of dialogue across gameplay with participants discussing "juggling ideas and thinking about the consequences of their actions". However it must be noted that the Austrian students elected to change the rules of 4Scribes before they began play so that everyone could see everyone else's cards. This perhaps removed the element of competition and non-collaboration that had been holding back the UK students from engaging in more dialogue, and allowed the most involved of the Austrian students to really negotiate their ideas and how they fitted together.

3.1.3 BEING IN CONTROL

(Taking charge of parts of the creative process (understanding rules of the system, decisions have consequences, making decisions, taking action.)

The UK secondary data showed a variety of takes on the idea of 'Being in control'. It translated as students *not feeling in control* due to the way the 4Scribes rules made them play. It also translated as students *taking control* to play strategically around some of these issues in order to lead the story to their desired ending. UK primary students also showed evidence of *being in control* as well as wanting to be in control of the game; and both sets of UK students showed evidence of using humour as part of achieving this. This range of types of control is perhaps reflected in the UK secondary students' responses on the creativity wheel where students mostly responded on the middle level, with one on the lowest level.

Interestingly the UK secondary teacher questioned whether having to have a winner forced a level of competitiveness which was detrimental to fostering their co-creativity, which links to the point above regarding Austrian students being able to remove competitiveness in favour of collaboration by showing each other their cards. The UK secondary teacher also pointed out that they thought that overall the detachment between player turns limited any tactical manoeuvres, and in turn perhaps the control the students felt they had over the game. The UK primary teacher recognised that the possibility of *being in control* in a competitive way was perhaps not an advantage as it allowed more dominant children to take the lead. Similar relationship dynamics were identified in the Austrian secondary student groups with, despite the best efforts of students who noticed the imbalances in control and tried to rebalance them, some students took such passive roles that they asked their group leader what to write on the card. Stepping back more generally to consider the Austrian secondary data though, there was evidence of most of the participants being able to exert *some kind of control* over gameplay and of their creative experience through it, via transforming the meanings of cards, and even going so far as to create an unrequested rap (spoken word poetry) out of their story. The Austrian researcher highlighted students *being in control*, both individually and as a group (apart from the one student indicated above in the passive role) as a strong factor in the development of the game, with them going so far as changing the rules across gameplay and disrupting the initial input from the teacher.

3.1.4 ENGAGED ACTION

(Being immersed in the experience. Being addicted, not able to stop, trying repeatedly. Such immersion sometimes leads to taking risks.)

In the UK secondary data there were differences in reporting from different data sources regarding engaged action. 3 out of the 4 students indicated that they felt that they had been engaged or ‘immersed’ in the experience ‘Quite a lot’ and this was supported by the UK secondary film data showing students *deeply engaging* in developing surprising story lines. And yet, both UK secondary students and teachers reported in interview that the wait between turns was seen to cause a lack of engagement in the game, with some students almost completely disengaged in between turns as the teacher allowed them to read a book. Therefore, although the creativity wheels and film data indicate bursts of engagement were possible when players had their turn, a longer kind of immersion in the game in the UK secondary site was not possible in its current format. In contrast, the UK primary teacher reported that the children wanted to continue playing after the pilot as they understood the game better, the more engaged they became, although also indicating that their engagement might be due to the competitive nature of the game. In the Austrian secondary site there also seemed to be a range of engagement in the game, which might have been connected to the meaningful interlinking of learning activities and their relationship to who was in control of group dynamics, with the suggestion that *those more in control were more engaged*. There was also evidence from one of the Austrian groups of extremely deep immersion in the C²Learn gaming activity which saw them gaming in their non-contact time, creating a DVD cover, writing a script – all unrequested by their teacher. The Austrian researcher commented on the implications of this for the development of C²Learn activities

in the classroom more widely and understanding how the activities could build into other non-digital teaching and learning in different curriculum areas.

The Austrian researcher highlighted a possible extension of the engaged action category which will need further investigation in the next stages of piloting to verify it. This was the notion of *collaborative transformational agency* where students' and teachers' lived experience saw collaborative agency as a great driver for engagement in their class and beyond. In the Austrian analysis, the experiences of collaboratively transforming meaning by the students emerged throughout the pilot phase. It is difficult to judge whether this collaborative transformational agency was due to the intensity of the Austrian pilot which occurred during a one week intensive workshop based on curriculum crossing domains (German, music , IT). From here this theme needs to be considered across the UK and Austrian sites in the next *C²Learn* pilot in order to try to ascertain whether it has the potential to occur in other *C²Learn* sites too as a part of *C²Learn* gameplay.

3.1.5 INTERVENTION AND REFRAMING

(Specific changes in thinking patterns, and in particular reasoning processes. Changes in expression, primarily in linguistic terms, but also encompassing other modes as well.)

In the UK sites, intervention and reframing was the least consistently evidenced of the five co-creativity criteria, despite the fact that on the creativity wheels all the students marked themselves in this category as 'Quite a lot'. UK students were able to comment on being able to "*disrupt*" thinking and being aware of their power to change the direction of the story and in so doing develop new ideas. These were found in relatively isolated incidents within quite short stretches of UK gameplay but their existence does seem to indicate that intervention and reframing might be possible within this gaming context. Within the Austrian data intervention and reframing was found to be a much more constant activity in the *C²Learn* pilot experiences, because every time students played a card they intervened and told the ongoing story differently, so they reframed what had been given initially. It may be though that this represents a more open interpretation of the category than in the UK data analysis. This issue of interpretation may need attention in the next round of piloting and will be aided by the incorporation there of data analysis from the Socratic Dialogues which was not present in this piloting phase.

3.1.6 4Ps

(Evidence of high participation [engagement and involvement], high pluralities [taking on many roles, personae, perspectives], high playfulness [operating in an as if and playful manner] and high possibilities [generating many ideas through what if and as if thinking].)

In the UK sites, students expressed differing views about their participation and possibilities in the game. The two students that marked themselves as relatively high on participation described their gameplay as "fun" and "exciting". This was supported in the video capture where they appear to enjoy the competitiveness of disruptor gameplay where they exhibit possibility thinking within a playful role. For example, one student contributed a very

imaginative twist to the story which illustrated his imagination and the accompanying possibility thinking at play. Possibility thinking was also evidenced in the UK in post gameplay discussion, when students were thinking of ways in which the game could work in school. In English they believed it could be a revision activity, with certain vocabulary or punctuation being incentivised. They also saw the potential for using the game as a story telling tool. Even though one student marked herself into the negative zone on participation and possibility, on the film capture she animatedly found a way for those who had been left behind to be reintegrated into the story. This illustrates participation in picking up on and developing part of the story line perhaps a little more than her own grading gives her credit for on the Axes. UK teachers reported they believed 4Scribes had real potential for combining playfulness and possibilities. One SE teacher mentioned that he could perceive the benefits of “disciplining their creativity”, because he saw this as good for students’ thinking skills. This perhaps relates to how he perceived the quality of the students’ participation. Importantly, the UK teachers recognised the need for more playing time in order for the students to get comfortable enough to start to think ahead during gameplay. There was little evidence of discussion of the idea of pluralities in the UK, but this is likely because of the limited nature of the piloting and the prototype in this phase.

The Austrian secondary data illustrates self-reported high possibility and high participation by all students involved. All gameplay activities had a strong group dynamic and different degrees of high participation, where at times there were leaders, who took control over almost the activities and others have been rather passive, but still report high participation and possibilities. One student on the lower spectrum of high participation stated on interview that she liked the gameplay activity but she is not good friends with the leading participants and as a result felt demotivated due to the group dynamic, but not due to the gameplay

3.1.7 UNDERTAKING A JOURNEY OF BECOMING

(Over time, noticeable changes in participants’ dispositions and/or personalities. This may involve smaller incremental changes.)

Due to the very short timescale of the pilot, there was limited evidence of ‘journeys of becoming’. With the longer pilot timescales forthcoming, we hope to find robust evidence of noticeable changes (even small changes) in students’ and teachers’ dispositions and/or personalities. In the Austrian site, the researcher observed an *incremental and cumulative change* in one student’s dispositions and/or personalities who was new to the class. At the beginning of the pilot, the student was very cautious and self-contained but as gameplay continued over the course of the one week intensive, the student became highly engaged especially when the students collaboratively transformed the story into a screenplay that was produced into a film. At the end of the pilot, when his group showed the film and everybody was watching, his heart started to pump so hard, that he showed everybody his chest and how it moved with the heartbeat. On film, he exclaimed with a surprised smile, “I have never felt something like this before”. This example succinctly illustrates one participant’s journey of becoming, as he transformed from a newcomer to what the teacher has described as ‘the hero of the group’.

3.1.8 GENERATING QUIET REVOLUTIONS

(Over time more noticeable changes in the creative community stemming from creative ideas generated; might comprise smaller incremental changes.)

In the UK, the short time frame of the pilot limited to possibilities to generate quiet revolutions, yet one noticeable change was that the students' exhibited more confidence amongst themselves. The teachers also commented that was evident amongst the group of students and believed if 4Scribes was used with more students at scale, rather than just the pilot students who volunteered, it likely had the potential to boost student confidence more generally. This highlights the *potential for change* might be possible through gameplay and immersion in C²Learn gaming and social networking environment and that researchers should remain alert to this during the next piloting phase. In the Austrian site, like due to the compressed timescale, quiet revolutions were not observed, but what was observed was students revisiting their playing 4Scribes and the collaborative stories they authored. The Austrian researcher noted the group grew more cohesive as a result of this revisiting activity. This is something to be considered in the subsequent pilot, the idea of revisiting collaborative storylines and the possibility of generating quiet resolutions upon reflection of gameplay.

3.1.9 PEDAGOGIC STRATEGIES

(Evidence teachers proactively valuing learners' ideas and actions; enabling learners to take the initiative; ensuring sufficient space and time for ideas and actions to emerge getting alongside the learner and learning as fellow collaborator.

In the UK, on interview the teachers concluded, upon reflection, that they had used different pedagogic strategies. Some were practical differences associated with a small group and a high teacher: pupil ratio and 'teaching' with two teachers. However these changes are more related to the piloting circumstances than the C²Learn experience per se. In the open-ended Socratic interview in the SE of England teachers discussed how 4Scribes gameplay is useful because it "encourages you to prompt without telling" and that "that kind of open ended questioning teaches valuable lessons as a teacher". Both SE teachers also reported having to hold back during play, and this is clearly related to the C²Learn pedagogy of standing back, meaning that for teachers to allow creativity to happen they need to know when to stand back and let students take control. This example perhaps provides a little evidence that standing back was occurring around these short episodes of gameplay and this will be important to highlight in subsequent pilots. In the SW of England, the teacher only had a short amount of time to try out the game with students so there was less comment on pedagogic strategies. However, he did make recommendations for future gameplay. He suggested not using the randomised premise and allowing the children to generate their own premise that might have more relevance to their lifeworlds. He also discussed how relating story ideas to curriculum areas in the future would be fruitful; this is obviously something the school will be able to pilot in the next phase of the project. In the Austrian pilot there was not an explicit focus on pedagogic strategies, rather the focus was on facilitating gameplay.

4. IMPACT OF PILOT FINDINGS ON THE ASSESSMENT METHODOLOGY

A couple of general observations about the evaluation methodology for *C²Learn*: At one level, this evaluation study is an internal matter aimed at evaluating progress in the project. However, any curriculum intervention into schools needs to come with methodology for evaluating students' progress. For teaching creativity, this is not quite as straightforward as for more familiar domains. We believe that there is an intimate relation between the reflective processes engendered by **Socratic Dialogue (SD)** and both the teaching and evaluation of educating for creativity, and that there is therefore a closer than usual relation between a research methodology, and what will eventually need to appear within *C²Learn* in school use. This is especially so because of the *immersive* nature of computer game play, and the resulting need for reflection to achieve generalisation.

The M21-cycle pilot revealed a number of problems with the design of our methodology, especially as concerns the UEDIN led part of the process, which heavily relies on SDs. We thus took the pilot findings as an opportunity to revise our approach. The main changes made to the evaluation study for the second pilot are as follows²:

- 1) Originally we had planned to conduct *immersive* gaming sessions and *reflective* Socratic dialogues in the same 45 minute session. Piloting findings suggest that this is too tight for time. Both the *reflective* and *immersive* sessions seem to benefit from a more generous time frame. We believe that the *reflective* sessions may be very important to the creativity learning, especially in getting students to generalise what they have learned while gaming. We also believe that it will be possible for students of these age groups to reflect back on previous sessions. So we have decided to change our approach so that full 45 minute *immersive* and *reflective* sessions alternate.
- 2) The other main change is that SDs will be conducted on a whole class basis, rather than in sub-groups of 5 to 6 as originally proposed. Researchers reported logistical problems with our initial design, especially as concerns time and class management. This whole class method worked well in piloting and solved the logistical problems of separating sub-groups. The main thing we lose is the ability to compare a group who only do SDs once at the end (a control group for the impact of the SDs themselves). We are currently researching a way to reinstate this last feature.
- 3) To complement the above alteration, we have decided to relax the prerequisite of SDs being conducted only by teachers. We now allow for the researchers too to either conduct the SD, or help the teacher in conducting it. Again this change arose due to logistical considerations that were voiced repeatedly during the pilot.
- 4) We found that researcher input (in addition to the teacher) was sometimes necessary for the scoring of SDs, whereas it was originally planned that this would be done by the teacher alone. This is a relatively small change. We suspect that with repeated practice, the teachers

² For details on the current state of the assessment methodology the please refer to **D2.3.2 Co-creativity Assessment Methodology**.

could rapidly become quick enough to do this alone, an important issue for rolling out any C²Learn curriculum in schools outside the project.

5) We have decided to institute the collection of both the students' and the teachers' identification of **crucial events** during a C2Experience (immersive session) and SD (reflective session) at the ends of each session. This is a very useful source of evidence about the degree to which the teachers' and students' understanding of the C²Learn process converge during the study. It may be possible to compare this with the computational system's ability to identify episodes.