Matrix Game for military language training

Jose Anibal Ortiz Manrique

Burnham Lecturer Spanish, Defence Centre for Languages and Culture.
Defence Academy of the United Kingdom.

This work is the result of a collaborative process between the Modelling and Simulation department, and the Defence Centre for Languages and Culture (DCLC) of the Defence Academy of the United Kingdom. At the Modelling and Simulation department Tom Mouat has adapted Matrix Game, invented by Chris Engle in 1982, for military training purposes. After attending one of his workshops on the mechanics of the game, I found Matrix Game could be an educational tool for language training. In particular, because it encourages students to interact, and to incorporate into language learning a range of skills they have gained during their military experience - such as, leadership, team-working, problem solving, and creativity. For this reason, I started working with Tom to integrating Matrix Game into learning Spanish at DCLC. The goal of this paper is to present an analysis of the educational benefits of the integration. The paper starts by explaining the learning approach adopted to carry out this integration. This explanation is followed by a pedagogical proposal for using Matrix Game in the classroom. Finally, the paper discusses the positive impacts of the game for learning Spanish.

The Spanish department at DCLC provides language training to personnel from the different Services of the Armed Forces. It offers four language proficiency levels according to a NATO Standardization Agreement (STANAG 6001). I have integrated Matrix Game as an educational tool for blended learning. The game was invented by Chris Engle in 1982. The mechanics are very simple. It starts with a *problem* players need to solve collaboratively. Then the teacher sets up the *scenario information* to carry out the game: the context, the characters, and their specific objectives. After creating this scenario, participants play in turns saying what they are going to do to solve the problem (Actions); why they are going to do that (Result); and some reasons why they think that it is possible to do it (Reasons). Every action must be supported with at least two reasons. This narrative structure - Action, Result and Reasons- is called an *'argument'*. The other players then get a

chance to interject any reasons they might think of in support of or against the argument. If they think the reasons presented by a player are good enough, then the following player should take his turn. The other players then get a chance to make additional arguments either in support of the original argument (Pros) or against it (Cons). When the reasons given by the players are not totally convincing, then the teacher or facilitator can roll a dice, and the player with the highest number wins. This keeps the narrative moving along. The game ends when the problem is solved. For language learning teachers can use Matrix Game to introduce a topic, after a learning activity, or as a formative assessment. To illustrate this I have designed the following pedagogical proposal organised in three phases with the activities teachers can do before, during, and after the game.

Before the game

The teacher can create the problem based on the topics of the language course. For example, if the topic of the week is 'drug trafficking', the problem could be as follows:

A Drug Baron has kidnapped an activist in a town. As a result the governor has requested the Army Commander to rescue him.

The problem provides the *scenario information* to carry out the game: the context, the characters, and the possible objectives for each character. In this case the context is a town. This information enables the teacher to search or design a map to play the game (*Figure 1*). The map must be suitable for students' needs and interests. For instance, if students are learning Spanish, the perfect location is a town in Latin America or Spain.

Figure 1: Map for playing the Matrix Game: 'The kidnapping'.

Then the teacher chooses the main characters to play the game, in this case, the *Drug Baron, and the Army Commander.* Depends on the size of the group of students the teacher can create more characters such as: the Governor, the Police Chief, the Undercover Agent in the drug dealer organisation, and/or "The Spirit of Drama" whose role in the game is to make things go wrong for the players in a way that makes the story more exciting. After selecting the characters, the teacher produces a card for each one containing background information, and three objectives (*Figure 2*).

Army Commander

You have heard that an outspoken critic of the Drug Baron has been kidnapped and taken hostage from the Village at GR2184. The Governor insists he must be rescued!

This is, of course, primarily a Police matter, but you know some of them are corrupt, and don't have the manpower or resources to mount a rescue, so it is time to show them what the Army can do!

Objectives:

1. Rescue the Hostage!
2. Show how great the Army is!
3. Do something that will get you promoted and transferred to the city!

Drug Baron

One of the local villagers has been an outspoken critic of you! You have ordered him to be kidnapped and held for ransom.

You do a lot for the locals in these hard times. If it wasn't for your kickbacks and employment many would starve. They are ungrateful and need a lesson! You have a Police informant in your pay...

Objectives:

1. Make money!
2. Teach the locals a lesson!
3. Survive the game alive and free!

Police Chief

You have heard that an outspoken critic of the Drug Baron has been kidnapped and taken hostage from the Village at GR2184. The Governor insists he must be rescued!

This is, of course, a Police matter, but you don't have the manpower or resources to mount a rescue, so you will need help from the Army!

Objectives:

1. Rescue the Hostage!
2. Show the Police are not corrupt!
3. Make sure you get credit from the operation!

Village Leader

A young man who was an outspoken critic of the Drug Baron has been kidnapped and taken hostage from the Village (GR2184). His family is distraught and are trying to raise the ransom!

This is a difficult situation. The Drug Baron provides money and employment to the village in these hard times and the corrupt Police are no use.

Objectives:

1. Have the Hostage returned!
2. Don't anger the Drug Lord!
3. Look after the Village!

Figure 2: Example of characters for the Matrix Game: 'The kidnapping'.

After setting up the context, the characters and their objectives, the teacher needs to elaborate some counters to play the game. According to the problem mentioned above, and with the learning outcomes of the language syllabus, I have designed the following counters (*Figure 3*). They are organised based on the military and social vocabulary students need to learn (*Table 1).* These visual resources allow learners to remember words, phrases, and to build their arguments for the game. More importantly, the association between the images and the words facilitates long-term memory (Paivio, 2007, p. 77).
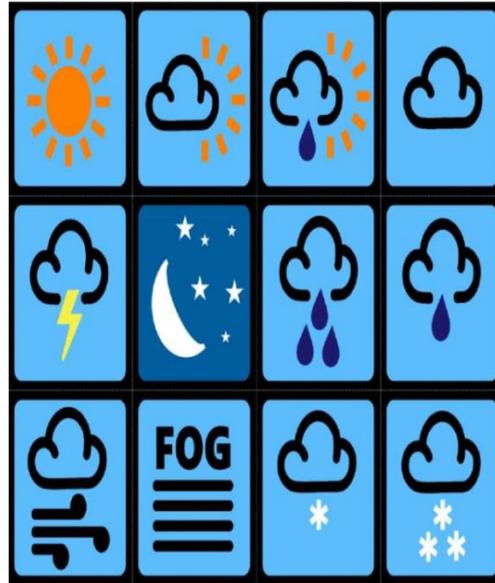
Figure 3: Example of counters for the Matrix Game: 'The kidnapping'.

Table 1: Example of vocabulary for playing the Matrix Game: 'The kidnapping'.	
Places	Army base
	Police station
	Checkpoint
	Ruins
	Farm house
	State
	Plantations
	Jungle
	River
	Lake
	Tunnel
	Bus stop
	Main highway
Weapons	Rifle
	Machine gun
	Grenade
	Rocket launcher

Vehicles	Car
	Police car
	Jeep
	Van
	Bus
	Truck
	Tractor
	Ambulance
	Tank
	Armored vehicle
	Patrol vehicle
Aircraft / Watercraf	Airplane
	Helicopter
	Drone
	Boat
	Inflatable boat
	Ship
Military personnel, and civilians	Soldier
	Commander
	Police Chief
	Policeman
	Sniper
	Terrorist
	Drug dealer
	Hitmen
	Kidnapper
	Hostage
	Victim
	Undercover
	Informant
	Village leader
	Farmer
Weather	It is sunny.
	It is raining.
	It is windy.
	It is foggy.

	It is misty
	There is a storm.
Verbs	Take / Move / Cross / Build (a tunnel) / Attack / Put (a bomb) / Navigate / Infiltrate/ Send (a drone) / Kidnap / Rescue / Bribe / Kill / Ambush.

During the game

Once the teacher has created the problem and scenario information of the game, he can explain the students the rules of the game. Due to my experience the teacher must not spend more than 5 minutes doing this. As happens in any game, players can learn the rules and mechanics whilst playing, and with the teacher's support.

After doing a short explanation of the game, the teacher gives each student a card with the character he needs to represent. Then he explains students the language content required to play the game, and shows them an example of how to express an '*argument*' (*Table 2*).

Table 2: Linguistic structures students can use for playing the Matrix Game: 'The kidnapping'.

ACTION + RESULT

Grammar structure: Be going to + Infinitive + *to*-infinitive

For example:

For military role:
- I am going to + take my troops to the bridge + to set up a checkpoint.
- I am going to + send a drone + to take photos of the area.

For terrorist role:
- I am going to + call the governor + to ask for money.
- I am going to put a bomb + to explode the police station.

REASONS

Grammar structures:

It is possible +

Because + Have

Because + Be
Because + Can

Because + It is sunny/windy/cold/foggy/misty

Because + <u>There is</u> a storm

Because + Be + Prepositions for place (near/far/next to/behind..)

For example:

For military role:

- Because + I have the military personnel.
- Because + I have the weapons.
- Because + the place is near the military base
- Because + we can
- Because + our troops are prepared /trained/ fast/brave. Because I can shoot the target.

For terrorist role:

- Because + I have money.
- Because + I have weapons.
- Because + I am powerful in the region.

For example, *The Army Commander* player can start the game by saying:
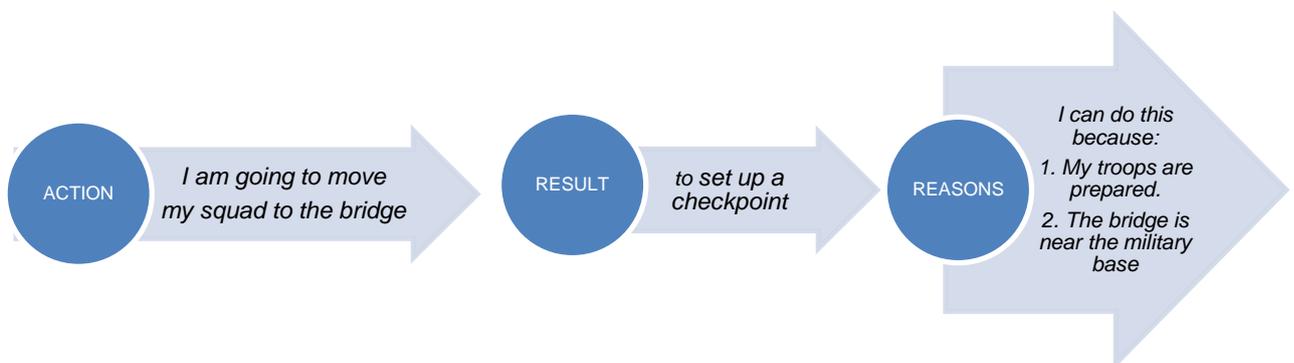
If the other players do not have objections to the movement of the Army Commander, then he puts *the squad and checkpoint* counters at the bridge in the town *(Figure 1),* and the next player takes his turn.

The squad counter
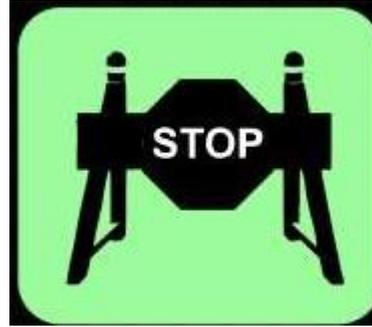
The check point counter

There are other types of interactive tasks students can do during the game, such as, role-plays, interpreting and translation, oral and written summaries. For example, if the 'Drug Baron' expresses the following 'argument', *'I am going to call the Governor to offer him money',* the teacher can ask him to simulate a role-play with the Governor. If there is a student who is not engaged with the game, the teacher can encourage him to do simultaneous interpreting or translation of the role-play. After each round in the game the teacher can select a student to summarize the story that players have built together.

After the game

Students can write a summary of the story they have created throughout the game. This kind of task contributes to enhance writing skills, as well as long memory retention. Finally the teacher can provide feedback to students about their performance in all tasks.

This is an example of one of the scenarios I have created for the design of matrix game as an educational resource to enhancing language learning. For this design I have considered the Balanced Design Model (MIT, 2015, p.11). This model ensures the mechanics of a game is aligned with the learning outcomes of a particular subject or topic. The model is organised through three main elements: The Content Model, The Task Model, and The Evidence Model.   Regarding Matrix Game design

for language learning at DCLC, the first element concerns the learning outcomes for all language skills provided by NATO STANAG 6001. It includes linguistic competence: linguistic control of vocabulary, grammatical accuracy, phonology, and orthography; sociolinguistic competence (relevant knowledge of the topic of the game); pragmatic competence (flexibility, turn taking, thematic development, coherence, spoken fluency); communication strategies for reception, interaction and production (identifying cues and inferring; turn taking, co-operating, asking for clarification; production planning, compensating, monitoring and repair) (CEFR (2001, p 9). The second element, the Task Model refers to the different tasks students can perform during and after the game: interaction with arguments, role-plays, interpreting, translation, oral and written summaries of the situations that happen during the game, and reading of those texts. The third element includes the language proficiency levels students can achieve according to their performance in the tasks. The table below shows an example of how we can align the experience of playing the game with the language learning process by relating the three elements of the Balanced Design Model (*Table 3*).

Table 3: The Balanced Design Model for using Matrix Game for language learning.		
CONTENT *Learning outcomes according to NATO STANAG 6001*	TASKS	EVIDENCE • *Type of evidence.* • *Criteria to assess students' performance in the tasks.* • *Interpretation of evidence.*
Listening Able to understand	Task 1: Interaction with arguments.	• *Type of evidence: recording of the students' performance.*

all formal and informal speech on practical, social, and professional topics.	Task 2: Role-plays Task 3: Interpreting Task 4: Translating Task 5: Listening to students' stories.	• *Criteria to assess students' performance in the tasks.* **Student achieves Level 1 if he/she:** Can understand common familiar phrases, and short simple sentences. Can understand concrete utterances, simple questions and answers. There are many misunderstandings of both the main idea and supporting facts. **Student achieves Level 2 if he/she:** Sufficient comprehension to understand conversations face-to-face in a standard dialect, delivered at a normal rate with some repetition and rewording. Can understand narration about current, past, and future events. Shows ability to follow essential points of discussion or speech on topics in his/her special professional field. **Student achieves Level 3 if he/she:** Demonstrates, through spoken interaction, the ability to effectively understand face-to-face speech delivered with normal speed and clarity in a standard dialect. Demonstrates clear understanding of

		language used at interactive meetings, and other forms of extended discourse, including unfamiliar subjects and situations. Can readily understand language that includes such functions as hypothesising, supporting opinion, stating and defending policy, argumentation, objections, and various types of elaboration. Demonstrates understanding of abstract concepts in discussion of complex topics. Understands both explicit and implicit information in a spoken text. Rarely has to request repetition, paraphrase, or explanation. • *Interpretation of evidence: Analysis of students' performance, and action plan to improve it.* *For example: when students' participation is low, it is important to analyse both the mechanics of the game and his/her communicative competences.*
Speaking Able to participate effectively in most formal and informal conversations on practical, social, and	Task 1: Interaction with arguments.	• *Type of evidence: recording of the students' performance.* • *Criteria to assess students'*

professional topics. Can use the language to perform such common professional tasks as answering objections, clarifying points, justifying decisions, responding to challenges, supporting opinion, stating and defending policy.	Task 2: Role-plays	*performance in the tasks.* **Student achieves Level 1 if he/she:** Able to maintain simple face-to-face communication in typical everyday situations. Can create with the language by combining and recombining familiar, learned elements of speech. Can begin, maintain, and close short conversations by asking and answering short simple questions. Can speak at the sentence level and may produce strings of two or more simple, short sentences joined by common linking words. Makes frequent errors in pronunciation, vocabulary, and grammar often distort meaning. May often use only one tense or tend to avoid certain structures. Uses hesitations, erratic word order, frequent pauses, straining and groping for words (except for routine expressions), ineffective reformulation, and self-corrections. **Student achieves Level 2 if he/she:** Can describe people, places, and things; narrate current, past, and future activities in complete, but simple paragraphs. Can state facts; compare and contrast; give straightforward instructions and directions; ask and answer predictable questions. Can confidently handle most normal, casual conversations on concrete topics. Can combine and link sentences into paragraph-length discourse. Can use simple structures and basic grammatical relations are typically controlled, while more complex structures are inaccurately or avoided. Can use vocabulary appropriate for high-frequency

		utterances but unusual or imprecise at other times.
		Makes errors in pronunciation, vocabulary, and grammar that may sometimes distort meaning.
		Student achieves Level 3 if he/she:
		Can demonstrate language competence in extended and elaborate monologues, hypothesising, and dealing with unfamiliar subjects and situations.
		Can reliably elicit information and informed opinion from native speakers.
		Can convey abstract concepts during the discussions.
		Produces extended discourse and conveys meaning correctly and effectively.
		Speaks readily and in a way that is appropriate to the situation.
		Without searching for words or phrases, can use the language clearly and relatively naturally to elaborate on concepts freely and make ideas easily understandable to native speakers.
		Can easily repair the conversation.
		Can make errors in low frequency or highly complex structures characteristic of a formal style of speech.
		Makes occasional errors in pronunciation, grammar, or vocabulary that are not serious enough to distort meaning.
		• *Interpretation of evidence: Analysis of students' performance, and action plan to improve it.*
Reading Able to read with almost complete comprehension the texts on common subjects.	Task 6: Reading the texts created by other	• *Type of evidence: one-to-one activity between the teacher and the student to assess his/her reading comprehension.*

	students.	• *Criteria to assess students'* *performance in the tasks.* **Student achieves Level 1 if he/she:** Understands the basic meaning of simple texts containing high frequency structural patterns and vocabulary. Can find some specific details through careful or selective reading. Can often guess the meaning of unfamiliar words from simple context. **Student achieves Level 2 if he/she:** Has sufficient comprehension to read simple authentic written material on familiar subjects. Can read straightforward, concrete, factual texts, which may include descriptions of persons, places, and things; and narration about current, past, and future events. Can locate and understand the main ideas and details in the stories. Can answer factual questions about such texts. Can readily understand prose that is predominately constructed in high frequency sentence patterns. While active vocabulary may not be broad, can use contextual and real-world cues to understand the stories. **Student achieves Level 3 if he/she:**

		Able to read with almost complete comprehension. Demonstrates the ability to learn through reading. Can readily understand such language functions as hypothesising, supporting opinion, argumentation, clarification, and various forms of elaboration. Demonstrates understanding of abstract concepts in the stories. Almost always able to interpret material correctly, to relate ideas, and to "read between the lines," or understand implicit information. Can generally distinguish between different stylistic levels and often recognises humor, emotional overtones, and subtleties of written language. • *Interpretation of evidence: Analysis of students' performance, and action plan to improve it.*
Writing Writing texts.	Task 7: Writing a summary of the actions that happen in the game. Task 8: Writing an analysis of the development of the game (the actions, ways of solving of approaching the problem, solutions).	• *Type of evidence: text written by the student.* • *Criteria to assess students' performance in the tasks.* **Student achieves Level 3 if he/she:** Can convey basic intention by writing short, simple sentences, often joined by common linking words. Has little evidence of conscious organization. Makes frequent errors in spelling, vocabulary, grammar, and punctuation Can be understood by native readers used to non-natives' attempts to write. **Student achieves Level 2 if he/she:** Can state facts; give instructions; describe people, places, and things; can narrate current, past, and future activities in complete, but simple paragraphs.

| | | Can combine and link sentences into connected prose; paragraphs contrast with and connect to other paragraphs.

Can organise the ideas according to major points or straightforward sequencing of events. However, relationship of ideas may not always be clear, and transitions may be awkward.

Can control simple, high frequency grammatical structures, while more complex structures are used inaccurately or avoided.

Makes errors in grammar, vocabulary, spelling, and punctuation that may sometimes distort meaning.

Student achieves Level 3 if he/she:

Has a control of structure, vocabulary, spelling, and punctuation adequate to convey the message accurately.

Apart from narration, and description, can use the written language for essay-length argumentation, analysis, hypothesis, and extensive explanation,.

Can convey abstract concepts related to the topic of the story.

The relationship and development of ideas are clear, and major points are coherently ordered to fit the purpose of the text. Transitions are usually successful.

Makes occasional errors that do not interfere with comprehension, and rarely disturb the native reader.

- *Interpretation of evidence: Analysis of students' performance, and action plan to improve it.* |
| --- | --- | --- |

Matrix Game positive impacts on Spanish language learning.

Matrix Game is a supportive learning tool that has promoted Spanish language learning as an interactive and collaborative process. The game contributes to enhancing language learning through a controlled interaction by using the specific linguistic features of the structure provided to play the game (Actions-Result-Reasons). The tasks of the game enable students to interact with their peers by focusing on the control and reinforcement of the linguistic elements that are important for second language acquisition, such as the use of morphemes. In particular Matrix Game has contributed to enhance the practise of morphemes to indicate the gender and number in nouns, and the person, number, and tense in verbs. After each turn, the repetition and correction of those linguistic features allow students to be aware of the language they are using during the tasks. This kind of controlled interaction contributes to language acquisition, especially at beginner language levels, as students can internalize the knowledge in a more explicit way (Ellis, 1999, p 228). In addition, Matrix Game provides students with the opportunity to interact spontaneously in the target language. This type of interaction allows them to explore their creativity by using different language content, and negotiation of meaning strategies when communicative problems arise. During the game students often use conversational strategies such as, comprehension and confirmation checks, repetition, and requests for clarification. These interactional adjustments enable students to have access to comprehensible input that, according to Ellis, facilitates L2 acquisition (1999, p 4).

The use of visual resources such as a map and counters contribute to language learning because the association between images and words help for memory retention

Regarding the importance of affect in language learning, Matrix game facilitates a learning environment where positive emotions arise. Our emotions and rational abilities are connected (Damasio, 1994; LeDoux,1996, cited in Arnold,1999, p.2). When learning language content, for example, our emotions may interfere or facilitate the learning process. For instance, Skinner (1957, cited in Arnold, 1999, p.2) claimed that positive reinforcement leads to more efficient long-term retention. On the contrary, negative feelings such as anxiety can be an obstacle for memory

and reduce learning capacity (Stevick, 1998, cited in Arnold, 1999, p.2). After informal observations of students' participation when playing Matrix game, we have noticed the game – its mechanics as well as the visual (the map and counters), and the experiential learning (body-kinaesthetic) resources - has promoted autonomy, intrinsic motivation, a sense of engagement and equal opportunities for all learners. Matrix Game is a motivating resource for learning. According to Malone *(1980, p.3)* there are three aspects a game must have to ensure students' motivation: challenge, fantasy and curiosity*.* A game is challenging for the players when the attainment of the goals is uncertain, but achievable. Malone (1980, p.50) lists four aspects that ensure this uncertainty of a game: variable difficulty level, multiple level goals, hidden information, and randomness. For example, in Matrix Game every player has three variable goals that have been created on the base of a variable difficulty level. However, this difficulty depends on both the player and his peers' non-linguistic and linguistic knowledge. *The Drug Baron* player may not be good in negotiation language skills to *make some money*, but he may have sufficient tactical thinking to *survive the game alive and free*. The use of different goals maintains players' interest, and enhances their equal participation.

I have also included "hidden information" in the game. For instance, in the case of the *Undercover Agent*, his identity cannot be exposed at the beginning of the game with the other characters. This uncertainty leads the other players to try some random strategies to discover his identity, first, and then to react accordingly. The selection of this character brings to the game a sense of incompleteness and inconsistency attracting the curiosity of all players. This situation engages students in the game because, apart from focusing on their specific goals, they need to solve an extra mystery. Matrix Game scenarios are built in relation to the experiences or knowledge of military personnel. However, the elements of the game- the map, counters, situations, characters, goals- as well as the ideas created by the students have a fictional content. This fictional content or 'fantasy' is important for an instructional environment to be more interesting and educational (Malone, 1980, p.56). Furthermore, it promotes an unconstraint and motivated learning context where students can build their knowledge when connecting to their previous one learning.

This motivation is equally ensured by the alignment of the game with the topic that the students have previously studied. That alignment enables students to put into context that previous knowledge -both the language content and the cultural information related to the topic- into the game. For example, for those students who have played the role of the Drug Baron character, the information they have gained in previous learning activities about famous Latin-American *narcos*, are an 'inspiration' to produce their 'arguments' for the game. As a result, it is common students use strategies to solve the problem of the game such as, crossing secret tunnels under rivers, building places surrounded by furious wild animals, and bribing the authorities.

Matrix Game has also promoted an inclusive learning environment because the students can integrate their prior video games experiences, military and non-military knowledge into language learning. For example, I have found that some students – due to their military knowledge- prefer to approach a situation in tactical way. Others use their video games or movies knowledge instead. In both cases the game encourages students to construct their language knowledge building on their own interests and knowledge (Biggs and Tangs, 2011, p 21). Without losing the 'spirit' of a competitive game, the game creates a positive interdependence among the participants as every member's goal accomplishment is linked to an understanding of each other. Matrix Game is a collaborative learning experience that encourages the recognition and importance of the others - not only the teacher- into language learning. Students have the opportunity to critically reflect on the language used by receiving feedback from their peers and the teacher; and they have the opportunity to apply those experiences into new Matrix Game situations. Those conditions enable learners' experiences to be organized in memory in order to build cognitive simulations to predict, act, and assess other situations (Gees et al, p. 22).

Conclusions

Matrix Game is an innovative educational tool resulting from collaborative work that has improved Spanish language teaching and learning at the Defence Academy of the United Kingdom. We often tend to believe games are solely a means to have a break from classroom routine. However, as has been explained in this paper, the use

of an appropriate learning model can transform a game, such as Matrix Game, into a rich learning practise. As other interactive activities this game can also contribute to learning by enhancing inclusive and collaborative learning, autonomy, motivation, and communicative competences. It is another alternative for teachers to carry out assessments in the classroom, and to effectively manage group diversity. The evidence we have collected for this analysis has not been the result of a rigorous research, but of informal observations and students' feedback. Thus it must be seen only as a guide, and not the only one, to continue enhancing the design and implementation of Matrix Game, and other games, in language training.

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Appendix

Map for the Matrix Game: 'The kidnapping'.
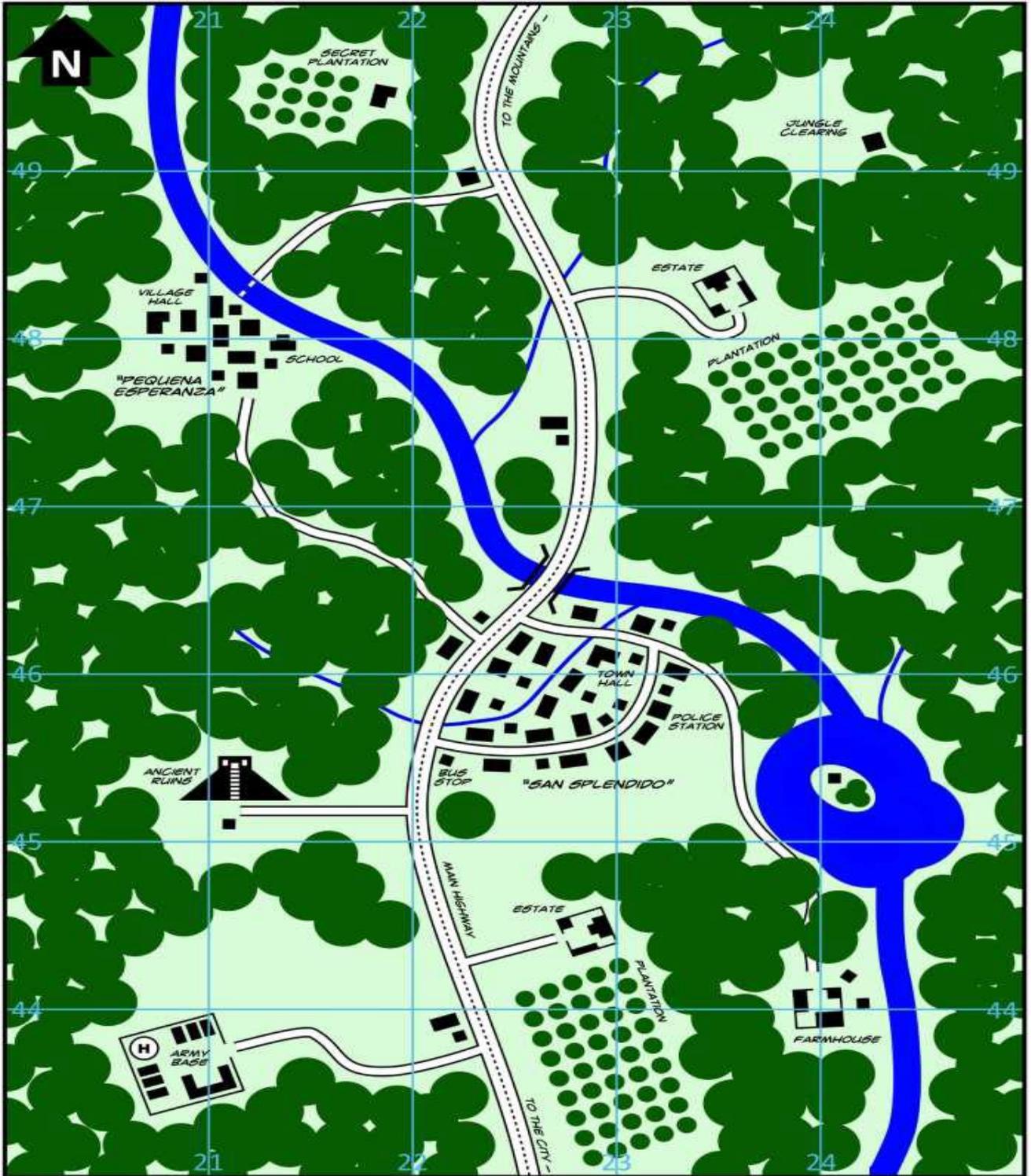
Characters cards for the Matrix Game: 'The kidnapping'.

Army Commander

You have heard that an outspoken critic of the Drug Baron has been kidnapped and taken hostage from the Village at GR2184. The Governor insists he must be rescued!

This is, of course, primarily a Police matter, but you know some of them are corrupt, and don't have the manpower or resources to mount a rescue, so it is time to show them what the Army can do!

Objectives:

1. Rescue the Hostage!
2. Show how great the Army is!
3. Do something that will get you promoted and transferred to the city!

Drug Baron

One of the local villagers has been an outspoken critic of you! You have ordered him to be kidnapped and held for ransom.

You do a lot for the locals in these hard times. If it wasn't for your kickbacks and employment many would starve. They are ungrateful and need a lesson! You have a Police informant in your pay...

Objectives:

1. Make money!
2. Teach the locals a lesson!
3. Survive the game alive and free!

Police Chief

You have heard that an outspoken critic of the Drug Baron has been kidnapped and taken hostage from the Village at GR2184. The Governor insists he must be rescued!

This is, of course, a Police matter, but you don't have the manpower or resources to mount a rescue, so you will need help from the Army!

Objectives:

1. Rescue the Hostage!
2. Show the Police are not corrupt!
3. Make sure you get credit from the operation!

Village Leader

A young man who was an outspoken critic of the Drug Baron has been kidnapped and taken hostage from the Village (GR2184). His family is distraught and are trying to raise the ransom!

This is a difficult situation. The Drug Baron provides money and employment to the village in these hard times and the corrupt Police are no use.

Objectives:

1. Have the Hostage returned!
2. Don't anger the Drug Lord!
3. Look after the Village!

Counters for the Matrix Game: 'The kidnapping'.